VOL. 62, NO. 28, PAGES 577-584

JULY 14, 1981

# Oceanography

470) Boundary layer on eachange processes Seasonal, Variations in the Upper Arctic Ocean AS OSSERVED AT T-1
James Moriaco (Faler Science Center, University
of Veshington, 6037 Rosseveit Ver NE, Seattle,
MA 98103) and J. Dungan Seith, Geophysics Program,
University of Veshington, Seattle, VA.
Hidtographic date from T-1 are analyzed to
ilitastrate the behavior of the Arctic mixed layer.
The mixed layer mainties fluctures II in avoually
and alred layer salinity fluctuates Q.32 0/co.
The fluctuation of the Arctic content age consistent with theoretical work b. Maybut and
are in phase with bland layer are controlled by are in phase with maked injer expth, indicating thacons in the mixed layer are controlled by sain flux. Designing of the mixed layer brings 0.3 kcal cm<sup>-2</sup> yr<sup>-1</sup> of heat to the surface from the neeam below.

Geophys. Res. Lett., Paper \$10793

4710 Chemical oceanography CALCOLATING THE OCEANIC CO<sub>2</sub> INCREASE: A NEED FOR CAUTION Alan M. Shiller (Scripps Institution of Oceano-graphy, University of California, San Diego, La John, California 92093)

graphy. University of California, San Diego, La dolla, California 2003)

A number of workers have presented calculations attempting to show the enthropogenic CO, increase in the ocean. These workers back-calculate the CO; concentration of a waiter parcel to when it was at the sea surface by using well-income nating to correct for chemical changes induced by blo-logical decomposition. Secans of the potential significance of these CO; back-calculations, their limitations are examined here. In the Angaritic intermediate Mater, which has served as a grimary testing ground for these back-calculation models, mixing it seem to significantly after created concentrations. However, previously used mixing corrections are shown to have little effect on an emalogous back-calculation of preformed of strate. A distionally, the results of the CO; back-calculations are probably too high for the waiter mass in question. Thus the ability of these methods to provide reliable extension of the creatic CO: increase is in doubt. (Carbon almost an increase, aniorstic intermediate water). J. de.phys. Bus., Grann, Paper 100999

4711 CARCULATION OF THE CAMEROCAN SEAT A MELL-RE-Soften Shreads Property Dean Resemble Moods Hole Oceanographic Inati-2-Lion, Moods Hole No. 02542, U.S.A.)

The Caribben See is selected as a region where the large scale circulation in well determined the large reals circulation in well designized by historical hydrographic measurements through application of the inverse method. A simple argue the inverse method. A simple argue in the designization of the inverse method. A simple argue in the second of the inverse given and the technique and to desarrante the how some giventally relevant quantiates may be sell determined in the formally; underdestermined inverse problem. The questrophic first field in the Caribbean is freed by imposing and and sell domestwates constraints in seven is part separated by surfaces of complete the seven is part separated by surfaces of complete special collisions. In discretize the first seath dependence on an initial choice of reference level. In addition, a surface semested relation is, shown.

Above 3 = 17-4, the tetal flew leaving the testing of the seath of the testing the caribbean from the seath of th

the east and flowing across the southern half of the basin as the Catibbean Current, and 7 × 10° at sec 1 entering from the north through Windward Passage. Both of these currents show small scale wariability that diminishes with distance from the respective passages. The deep flow has no ast transport, as required by the shallow axit, but a well organized elockwise recirculation is fround in the deep eastern Caribbean. (Caribbean Sas, inverse method, general circulation!

J. Gaophys, Rus., Green, Paper 100850

AND See ice
SEA ICE DISPLACIMENT PROM SEARAT SYMTHETIC
APPETURE RADAR
R. T. Hall (Folar Science Center, University of
Varbington, 4037 Rossavelt Vay NE, Seattle, WA
98105) and D. A. Rothtnek
Images obtained by a synthetic specture radar on
SEARAT have been used to measure see ice displacements over a three day interval in October 1978.
The position of a natural ice feature was measured
on 5 October and again on 8 October; the difference in these two positions is a displacement.
The displacement of many features was measured.
The tracked features lis roughly along a line and
are quite desse-shout 2 has part—over a diatance of 865 hs. The displacements are shout
twenty bloometers. Displacement errors grow with
distance from shore becoming as large as 3 kg.
The graph of displacement variany distance has
occasional discontinuities of several biloceters.
Displacement discontinuities are accurate to
4.0.07 hs sleng track and 32 of their magnitude
actume track, (SEASAT)
1. Geophys. Fos., Greon, Paper 100968

4765 Surface waves, tides and see level STATISTICAL ANALYSIS OF THE TSUNAMIS OF THE ITALIAN COAST MICHOE Capute (Istitute di Fisica "G. Mag coni", Università degli Studt, Rosse, Italy) and Gianfranco Faita.

The study of a catalogue of tsunamis of the Italian common allows to assign the intensity to 10 6 tsunamis of the GRIALOGUE which are listed accordingly. The statistic al analysis the data of this list since the year 1000 suggests the tentative density distribution

log n = 3.00 - 0.4251
where n is the number of taunamia of intensity I per thousend years. (Statistics, taunamia, Italian coasts).
J. Geophys. Res., Grann, Paper 101046

ATOS Surince vewss, Fides, and see level
MEASURPHORIO OF THE EQUILIBRIUM RANGE IN OCEAN
MAYE PROTERA
George S. Fortsteall (Shell Development
Company, P. O. Sock Adl. Mouston, Texasa 77001)
Wavesfelf measurements made in the Gulf of
Mexico and Waverider measurements from the
Bultimore Campon space have been used to study the
form of the squlitbrium range of ocean wave spectre. The analysis showed that the spectral range
buttered the measurement from the
spectral range of the spectral range
buttered the measurement of cocan wave spectre. The analysis showed that the spectral range
buttered the measurement proportional to the investigation of proportional to the investigation of spectral politics of the football politics
(see Appellant alith Copant level special later and spectral politics)

Language of a billinging politic later of the spectral politics

appellant of a billinging politic later of the spectral politics of the spect

meen period are known, the emplitude of the tall of the spectrum can be predicted with somewhat greater accuracy. However, this relationship should be used with couries when the height and J. Gamphys. Ras., Green, Paper 100848

4765 Surface waves ON THURMS NUCLEATION 8. Ward (Insverd University Department of Geolog-ical Sciences, 20 Oxford Street, Cambridge, MA

5. Ward (Harvard University Department of Geological Sciences, 20 Oxford Street, Cambridge, MA 02136)

Near-field tyunami formation is detailed in this paper using point mement tensor sources with a spherically symmetric, self-gravitating and alsotic Retth. Shepshots of vertical see surface motion calculated within 200 km and 100 seconds of an event typically show an initial taumani pulse slowly grow and then evolve into dispersed wave trains. The direction of first motion, the time and the length scales of the developing pulse contradict static concepts which hase taunami formation on permanent deformation of an otherwise rigid see floor supporting incompressible water. The permanent strain field at the sea floor is, in fact, irrelevant because it is defined by frequencies will below the range of taunami interest. Static concepts of taunami sense allowing such as esthquakes, whose motions are deeply tooted in elasticity theory. The general point soment censor used here produces frequency dependent tensor used here set at a strike slip sources, however, create waves that are symmetric or anti-symmetric about the spitcaster symmetric or anti-symmetric about the spitcaster. Buried 10 km with a memor of 10<sup>th</sup> km, are symmetric or anti-symmetric about the eni-canter. Buried 10 km, with a memant of 10<sup>14</sup> M-m, these sources generate initial camman pulses 40 km wide. Maximum amplitudes of 166 and 45 cm occur 10 km from the epicenter, 60 s after the dislocation. Taumanis from deeper earthquains are smaller, broader, and slower to develop be-cause they are deplated of bing frequencies. Cause they are deplaced of high frequent, George, Res., Red., Paper 180840

4790 Instruments and techniques.

SEASAT ALTINETER HIGHT CALIBRATION

R. Kolenkiewice (National Aeroneurica and Space Administration, Coddard Space Flight Center, Oreenbelt, MD 20771) C.F. Hartin

The Ceaset altimeter has been calibrated for helpht blas using four overFlight passes of Bernada which were supported by the Bernada Layer. The altimeter date was corrected for tides, using recorded tide guage date; propagation affects, using meteorological data taken around the time of each passe; acceleration lesi and see state blass, including both bufface affects and instrumental effects. Altimeter data for each of the four passes was monothed and extrapolated screak the Island. Interpolation between passes than produced an equivalent altimeter seasurement, to the good at the laser data sortes the later and destroyed the justified and seasurement. In the good at the laser data interpolation passes than produced an equivalent altimeter seasurement, to the good of the data of the passes of the passes of a good backs. The satisfact in ight blas was 0.0 10.07 m.

J. Georgia the sead accommons

1750 Intercept and bearings in Employ 18 Marking 18 Control of the State of the Sta

# **Editorial**

# Students Wanted

To advance the scientific study of the earth and its environment in space is the first and primary purpose of the American Geophysical Union. In support of this purpose. one of the working goals of the AGU is to attract competent individual students and research workers to devote their atignilon to geophysics, and another is to stimulate high quality education for students interested in geophysics. Only by attracting new minds to address old problems and thus uncover new questions can we assure the health of our science. Many of our subdisciplines are having difficulty holding good students through their Ph.D.s because of the attractive opportunities available to them outside the research community. This is challenge we must pick up-not lust to fill our ranks, but to fill them with the cream of the upcom-

Geophysics is by nature a focus of various disciplines on moblems, and thus it has an inherent problem in capturing

the attention of students at the undergraduate level. There are tremendous opportunities for promising physics, chemistry, and mathematics majors who are totally unaware of the exciting direction their education and career could take. To assist you in identifying opportunities that could be passed on to undergraduates in your institution, Eos has begun carrying announcements of predoctoral scholarships, fellowships, and graduate assistantships without charge in the classified advertising section. The addition of these student positions expands the popular marketplace for jobs in the earth and space sciences that Eos has become. Many of these advertisements will be directed primarily to undergraduate students. Since Eos does not have a large circulation to undergraduates, success will depend on the information in this section being passed on by facully advisors. You may want to copy these notices as they appear or post them or forward them to colleagues in other departments.

The inclusion of these announcements will be one in a

series of efforts to encourage good undergraduate students to pursue careers in geophysics. It is being guided by the Committee on Education and Human Resources, with strong support from the Oceanography Section in particu-

To use this new service, send your announcement of available student positions to Eos, Classified Advertising, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009. There will be no charge for the first insertion of such announcements so long as they are 20 lines or less. Subsequent insertions, if desired, will be run at half the regular classified advertising rate.

Il you do place an announcement, please help to improve the service by evaluating its impact. Send me your evaluation with your thoughts on other ways to assure that we can do an even better job of attracting and holding good students in geophysics.

lithospheric structure of rifts is more dependent on litho-

by a variety of processes. Some paleoritts on continental

margins are regarded as 'falled arms' of spreading axes,

type. Others are spatially and temporally connected with

and the East African rift may be a modern example of this

It is clear that continental rifts are diverse and may form

sphere properties than the mode of rifting.

Fred Splihaus

# Continental Rifting: Progress and Outlook

B. H. Baker Center for Volcanology University of Oregon, Eugene

P. Morgan Lunar and Planetary Institute Houston, Texas

Increased research activity on continental rifts has led to a flood of new data in the last 15 years, but there is little consensus about the basic mechanisms and causes of rift-



TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

# The Weekly Newspaper of Geophysics

Send double-apaced manuscripts (four copies) to Eos, AGU, 2000 Florida Avenue, N.W., Washington, D.C. 20009, or send them directly to one of the associate editors with a copy to the

Editors A. F. Spilhaus, Jr.: Associate Editors: Claude . Alegre, Peter M. Bell, Kevin C. Burke, Arnold L. Gordon, Kristina alsaros, Gerard Lachapelle, Christopher T. Russell, Richard A. Smith, Sean C. Solomon, Carl Klaslinger; News Writer: Barbara Richman; Editor's Assistant: Sandra R. Marks; Eos Pro-**Staff:** Patricia Bangert, Margaret W. Conelley, Eric Gar-rson, James Hebblethwalte, Dae Sung Kim, Michael Schwartz.

# Micers of the Union

J. Tuzo Wilson, President; James A. Van Allen, President-Elect; Leslie H. Meredith, General Secretary; Carl Klaslinger, Foreign Secretary; A. F. Spilhaus, Jr., Executive Director; Waldo E. Smith, Executive Director Emeritus.

Aftertising that meets AGU standards is accepted. Contact Robin £ Little, advertising coordinator, 202-462-6903.

08, Transactions, American Geophysical Union (ISSN 0096-3941) spublished weekly by the American Geophysical Union from 2000 Floida Avenue, N.W., Washington, D. C. 20009. Subscription available on request. This issue \$5.00. Second-class postage paid at Washington. Washington, D. C., and at additional mailing offices.

Copyright 1981 by the American Geophysical Union. Material pubne issue may be photocopied by individual acientists for esearch or classroom use. Permission is also granted to use short Woles and figures and tables for publication in scientific books and Ounals. For permission for any other uses, contact AGU Publications icalions Office, 2000 Florida Avenue, N.W., Washington, D. C.

Views expressed in this publication are those of the authors only and do not reflect official positions of the American Geophysical Union unless expressly stated.

Cover. Photograph shows the MST (meaosphere, stratosphere, koposphere) radar at Poker Flat, Alaska. This NSF-funded project was developed at Poker Flat, Alaska. was developed by the Aeronomy Laboratory of the National Oceenc and Almospheric Administration to investigate atmospheric onamics in the height range 2-100 km. The coherent (Doppler) ladar system operates continuously to obtain data on winds, Mayee, turbulence, and atmospheric stability. System parameters for the to the completed system include a peak transmitted power of 8 kW and an antenna area of  $4 \times 10^4$  m<sup>2</sup>. As seen in this photograph. gaph, the 64 transmitter modules are contained in separate houshas in the antenna array. The antenna is currently connected in a bree-has bree-beam configuration (vertical, off-vertical to the east and to the loss). Although completion is not scheduled until the end of 1981, a portion of the completion is not scheduled until the end of 1981. a portion of the system, operating at a lower sensitivity, has been in essentially continuous operation since February 1979. The building complex at the poker Flat Rocket ing complex at the top of the photograph is the Poker Flat Rocket Research Range operated by the University of Alaska (Photo taken by Paul E. Johnston and aubmitted by Ben B. Balsley, both of the Astonomy Lab, NOAA, Boulder, Colo.)

Ing. The well-known association of taphrogenic featuresdoming, faulting, and voicanism—is widely regarded as the result of asthenosphere convection and lithosphere thinning. This concept is supported by observations of longwavelength negative Bouguer anomalles, and of subnormal  $P_n$  velocities in the upper mantle, resulting from convective mass and heat transfer into the base of the lithosphere. Doming, and in some instances faulting, is the result of isostatic adjustment to the resulting expansion. The crust of rifts is abnormally thin (70-80% of normal) and contains high-density rocks assumed to be primarily intrusive basic igneous rocks. The collapse of rift floors may be the consequence of stress-induced lateral extension in the upper crust, possibly assisted by a mass excess of malic intrusions in the rifted crust. Anomalous electrical conductivity (low) and heat flow (high) are the result of heating and magmatic and hydrothermal activity.

Sengör and Burke [1978] have distinguished two basic modes of rifting: active rifting, in which the lithosphere is cracked by asthenospheric upwelling, and passive rifting, in which a preliminary cracking of the lithosphere occurs because of differential stresses resulting from the interactions of lithospheric plates. A variety of data sets have been interpreted to produce cross sections of the major Cenozoic continental rifts, examples of which are shown in Figure 1. Basic similarities in these cross sections mask subtle structural and evolutionary differences between the rifts, however, and tell nothing of the processes of lithospheric thinning. It is not clear to what extent the anomalous lithospheric structure is a response, as opposed to a cause, of rifting. In a recent volume of papers on the mechanisms of graben iomation [Illies, 1981], both active and passive modes of rifting are discussed, the former mode primarily in connection with the East African rift system and the latter with reference to the Rhinegraben. The remarkable similarities in rift cross sections (Figure 1) suggest that the anomalous

collision orogeny (Rhine; Balkal), and some appear to be intraplate structures with no clear relation to other tectonic leatures (Oslo; mid-continent U.S.). Special categories are needed for rifts in complex tectonic settings such as the Basin and Range of the western U.S., which may be an expression of back-arc spreading related to subduction, locally modified by the stresses imparted by the San Andreas transform fault. The Snake River-Yellowstone zone is a grabenlike feature, an elongated depression associated with little or no extension, and could represent a 'hot-spot' Viewed in this fashion it seems that there is a spectrum of rifting processes for which two fundamental mechanisms

can be postulated, similar to the two modes of rifting distinguished by Sengor and Burke [1978]: an active mechanism whereby thermal energy is transmitted into the lithosphere from the underlying asthenosphere, and a passive mechanism by which mechanical energy is transmitted laterally through the lithosphere as a consequence of plate interactions at a distance. There may also be combinations of these two mechanisms. In order to allow the concept of the two fundamentally different mechanisms to be tested, we propose a tentative classification that divides rifts into the two basic categories:

# Active Rifting:

(1) Ritt systems connected to midocean ridges and representing lateral extension as a result of asthenospheric convection. Structure is superimposed across older structures and has strong voicanism (e.g., East African rift sys-

(2) Smaller-scale rift zones generated by 'plumes' or 'hot-spots,' with little or no regional extension. Localized domes are formed by volcanism, with a trail of inactive troughs and grabens (e.g., Snake River-Yellowstone zone);

(3) Back-arc fault zones and grabens (e.g., Basin and Range, grabens of the Andes);

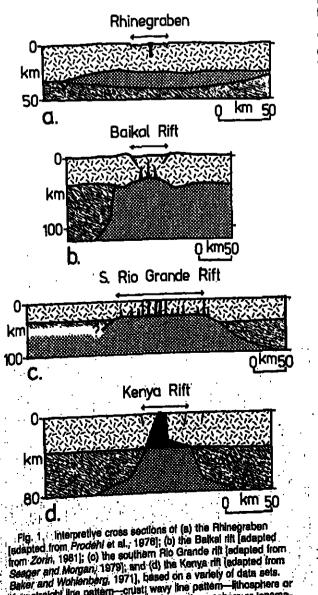
# Passive Rifting:

(1) Rifts associated with continental collision orogeny and formed by wedging and splitting of the lithosphere. The location and orientation is strongly influenced by preexisting structures, there is little igneous activity, and strike-slip motion may be locally important (e.g., Rhine-Rhone and Balkal

(2) Rifts associated with large strike-stip boundaries and resulting from the transmittal of shear stresses from the boundaries (e.g., western Turkey, Basin and Range).

The magnitude of active rifting will depend on the rate at which lithosphere moves over the thermal source, with ritts being restricted to stationary or slow-moving plates [e.g., see Burke and Wilson, 1972]. No such restriction applies to passive ritting, since the lithosphere thins in response to extension, and the source stresses are transmitted in the moving lithosphere plate. Other distinctions between the two mechanisms are in the influence of prerift structural elements, which should be strong for passive ritting and weak (or active rifting. Sengor and Burke [1978] give different sequences of events for the two modes of rifting; the active mechanism predicts doming-volcanism:rifling, the passive mechanism rifting-(uplift?)-volcanism. For active rifting the magnitude of uplift and volume of Igneous rocks should be much larger than for passive rifting, and a difference in igneous character may result: active-weakly alkaline to tholelitic; passive—strongly alkaline (?).

Data relevant to the understanding of the processes are not restricted to the earth. For 'one-plate' planets such as Mars, the processes of rifting are possibly easier to decipher, and the mechanisms can be applied to some rifts on Earth: The great Martian rift, Valles Marineris, is easily. modeled in terms of the stress field imparted by the topography and the gravity field (Figure 2) [Phillips and Lambeck, 1980). The modeling results strongly suggest that the rift followed the formation of the Tharsis Plateau: Rifts are also found on Venus, a planet that ought to be as thermally aclive as the earth but appears to lack contemporary terrestri-



Key: straight line pattern—crust; wavy line pattern—lithosphere or Johns, inbber wautie; solid plack battem—sethenosphere or anoma-round; inbber mautie; solid plack pattem—pasic cristal intrusions.

Fig. 2. Magnitude and direction of the theoretical horizontal tensile (principal) deviatoric stresses at the surface of the Tharsis Plateau (TP), Mars, imparted by the topography and the gravity field. Contours are magnitude of maximum stress, in kilobars. Note the orthogonal relationship between the Valles Marineris (VM) and the stresses. [Adapted from *Phillips and Lamback*, 1980].

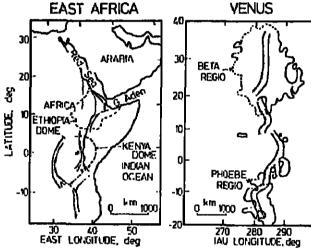


Fig. 3. Comparison between the East African rift system (cutting across the Ethlopia Dome and the Kenya Dome) and the major Venus rift system (cutting across the highlands of Beta Regio and Phoebe Regio). Depressions are indicated by the stipple pattern. (From George McGill, Univ. of Massachusetts, personal communication, 1981).

at-style plate tectonics. Analogies have been made between the Venus rifts and the East African rift system (Figure 3), but the role of rifts in the tectonics of Venus is poorly understood at this time.

Hydrocarbon, mineral, and geothermal resources associated with rifting give an additional economic value to rift studies. Ideatly models should predict the evolution of these resources. The diversity of rifts makes this a complex problem, however. In order to obtain a better understanding of rift processes and to apply adequate constraints to models, multidisciplinary studies of active rifts are needed to describe their evolution and to allow alternative mechanisms to be formulated and tested.

This problem and others will be addressed at a conference on the 'Processes of Planetary Rifting,' to be held December 3–5, 1981, at the Christian Brothers' Retreat House in the Napa Valley, California, immediately prior to the fall Annual Meeting of the American Geophysical Union (in San Francisco). Persons interested in attending the rift meeting should contact the Projects Office, Lunar and Planetary Institute, 3303 Nasa Road One, Houston, Texas 77058 or call (713) 486-2150 for further information.

# Acknowledgment

We thank R. J. Phillips for input and criticism of this manuscript.

# References

 Baker, B. H., and J. Wohlenberg, Structure and evolution of the Kenya rift valley, Nature, 229, 538-542, 1971.
 Burke, K., and J. T. Wilson, Is the African Plate stationary?, Nature, 239, 387-390, 1972.

illies, J. H (Ed), Mechanism of Graben Formation, Tectonophysics (Special Issue), 73, 266 pp., 1981.

Phillips, R. J. and K. Lambeck, Gravity fields of the terrestrial plants: long-wavelength anomalies and tectonics, Rev. Geophys. Space Phys. 18, 27–76, 1980.

Prodehl, C. J. Ansorge, J. R. Edel, D. Emler, K. Fuchs, S. Mueller, and E. Peterschmitt. Explosion seismology research in the central and southern Rhine graben—A case history, in *Explosion Seismology in Central Europe*, edited by P. Glese, C. Prodehl, and A. Stein, pp. 313–328. Seneral Verlag Partie. 1975.

and A. Stein, pp. 313–328, Springer-Verlag, Berlin, 1976.
Seeger, W. R., and P. Morgan, Rio Grande rilt in southern New Mexico, west Texas, and northern Chihuahua, in Rio Grande Rift: Tectonics and Magmatism, edited by R. E. Riecker, 87–108, American Geophysical Union, Washington, D.C., 1979.
Sengor, A. M. C., and K. Burke, Relative timing of rifting and voicenism on earth and its tectonic implications, Geophys. Res. Lett.

5, 419-421, 1978.

Zorin, Yu. A., The Balkal rift: An example of the intrusion of astherospheric material into the lithosphere as the cause of disruption of lithospheric plates, in Mechanism of Graben Formation, edited by J. H. Illies, Tactonophysics (Special Issue), 73, 91-

# Forum

# Flinn's Feature Fuels Forum

The entertaining note by Edward A. Filnn (Information transfer in verbal presentations at scientific meetings, Eos, 62, 179, 1981) brought to mind a somewhat similar discussion of this problem by the Scottish physicist, James Clerk Maxwell (1831–1879). Evidently, in response to a query from Professor Guthrie about the role of a physical society, which was something like an AGU meeting, he wrote in 1873 to W. G. Adams [Campbell and Gameti, 1884; p. 294]:

For the evolution of science by societies the main requisite is the perfect freedom of communication between each member and any one of the others who may act as a reagent.

The gaseous condition is exemplified in the solree, where the members rush about confusedly, and the only communication is during a collision, which in some instances may be prolonged by buttonholling.

The opposite condition, the crystalline, is shown in the lecture, where members sit in rows, while science flows in an interrupted stream from a source which we take as the origin. This is radiation of science.

Conduction takes place along a series of members seated round a dinner table, and fixed there for several hours, with flowers in the middle to prevent cross currents.

The condition most favourable to life is an intermediate plastic or colloidal condition where the order of business is (1) Greetings and confused talk; (2) A short communication from one who has something to say and to show; (3) Remarks on the communication addressed to the Chair, introducing matters irrelevant to the communication but interesting to the members; (4) This lets each member see who is interested in his special hobby, and who is likely to help him; and leads to (5) Confused conversation and examination of the objects on the table.

This pretty much describes an AGU meeting. Sleep is not explicitly mentioned, but it certainly occurs when (2) is not met, whereupon (3) flourishes, (4) is blatantly satisfied, and (5) follows.

It is interesting, if not somewhat surprising, that even though our language has changed a great deal in 100 years, our problems have not.

B. D. Marsh Earth and Planetary Sciences Johns Hopkins University Baltimore, Maryland

# References

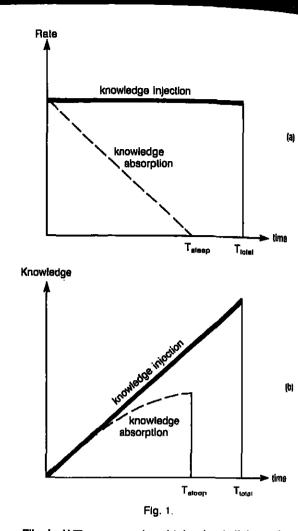
Campbell, L., and W. Garnett, *The Life of James Clerk Maxwell*, 421 pp., Macmillan, London, 1884.

In his article, 'Information Transfer in Verbal Presentations at Scientific Meetings' (Eos, 62, 179, 1981), E. A. Film raises some important issues. Unfortunately, the mathematical model is somewhat muddled. The internal inconsistency of the analysis became evident when I considered the conclusion that program chairpersons should stop the speaker at  $T_{\rm max}$ . It is understandable that a former AGU annual meeting chairman should advocate such a time-conserving approach, but Flinn's own Figure 1 shows the knowledge absorption curve at a maximum slope at  $T_{\rm max}$ . In other words, he advocates cutting the speaker off just as the audience is absorbing knowledge at a maximum

rate. Surely the optimum cutoff time would be later.

The AVT is defined as the *rate* of knowledge absorption, so its decrease after T<sub>max</sub> does not imply that T<sub>max</sub> is the 'point of diminishing returns.' The author's confusion at this point in the discussion is related to earlier ambiguity as to which quantities are rates and which are integrated amounts of knowledge. This problem would likely have been avoided if the basic rule of graphic presentation had been followed: 'LABEL ALL AXES.'

Suppose we rework the analysis, paying closer attention to the distinction between rates and integrated knowledge (Figure 1). 'Knowledge Injection' is at a constant rate (at least in Filmn's model). The audience attention factor goes linearly from 1 at l=0 to 0 at  $l=T_{\rm sleep}$ , so the knowledge absorption rate drops linearly as shown in Figura 1a. Knowledge absorption is the integral of that rate, the quadratic shown in Figure 1b. This result is nothing like the curve shown by Filmn.



Filnn's AVT curve can be obtained only if the audience attention factor is applied directly to the integrated knowledge injection. That operation represents a model in which, as sleep approaches, the audience loses any knowledge it had gained earlier. Given that model, which may have some validity, the speaker is indeed best cut off at T<sub>max</sub> when AVT is a maximum. Note, however, that in that case the AVT curve (not its integral) represents the knowledge absorption.

Richard Greenberg Nit Picker Planetary Science Institute Tucson, Arizors(

Regarding Edward A. Flinn's discussion on information transfer in verbal presentations at scientific meetings (Eos, 62, 179, 1981), it occurred to me that a similar theoretical approach could be developed concerning (1) the effect of consecutive talks on an audience and (2) duration (number of days) meetings should be. Factors which have to be considered for (1) are (a) times when talks are given (lowpriority talks being assigned to times early in mornings, lat in evenings, or on the last day of a meeting), (b) the impact of coffee breaks, beer sessions, and jet lag on both speak ers and audience (a different function for jet lag will exist for East and West Coast meetings), and (c) the effect of competitive sessions scheduled simultaneously at opposite ends of the conference center, or even, as commonly occurs, in different buildings. Regarding (2), external factors come into play such as (a) has the conferee brought his her family along? (b) median travel and per dlem allowances surviving in proposals (an indirection function of national election results), and (c) the quality of local night life. Finally, Flinn devotes no attention to speaker strategies to maximize rate of knowledge injection. This can be done in two ways. The first is to vary the rate of knowledge injection at different points in the talk, and the second is to extend audience attention by interjection of humor, use of altractive slides, or causing excessive audio feedback with AVT function more closely approach the integrated and ence attention function.

> James N. Nall Staff Scott Deep Sea Drilling F. Scripps Inst. of Oceanous La Jolla, Callo

# New address Attach present mailing label here Please allow up to be weeks for change to be ensured and all journals. New phone numbers (will be published in Directory): Office Homa Return to American Geophysical Union to be added as a construction of the const

# News

# Low-Gravity Materials Processing

The concept of growing crystals and of doing biological studies in the low-gravity space environment assumes that the absence of most, or all, of the influences of the earth's gravitational field on chemical and biological reactions is an important factor—at least important enough to justify costly

One normally thinks of the effects of the gravitational field as being like the effects of any other field, electric or magnetic, on a thermodynamic process. In the simplest terms, there is work done as parts of a system travel through a gravitational field; a more exact statement would be that the free energy of a system, and hence the state of equilibrium, depends on the position within a gravitational field. The thermodynamic effects of the earth's gravitational field (the equation for the changes in free energy caused by differences in position within the field) are subtle but could be important in chemical and biological processes.

One of the new technologies that has emerged from the space program is the practical processing of materials in an environment where the effects of gravity are greatly reduced or eliminated. Early work done in the field has shown that low gravity eliminates, or greatly reduces, the effects of buoyancy, sedimentation, and convection on materials processes.

A technical exchange agreement—the first of its kind—tas been signed between NASA and Deere and Company, Moline, Iii., to study the effects of low gravity on various ion alloys. Under the agreement, NASA's Marshall Space Flight Center, Huntsville, Ala., will use low-g facilities available to it—including drop tubes, KC-135 and F-104 aircraft, and possibly sounding rockets—to substantially reduce gravity conditions during alloy solidification experiments. Deere and Company will do sample preparation, ground-based characterization of the sample, extensive sample analyses, and data reduction, as well as thermal characterization of the furnace used for melting and solidifying the samples. The experiments and investigations performed under the agreement could eventually lead to Deere conducting research aboard a future space shuttle mission.

Data will be shared between the two parties. NASA and Deere personnel will visit each other's facilities and participate in experiment planning and analyses. The agreement is expected to be in effect for 1 year, but it may be extended in needed.

NASA currently is carrying out low-g processing in such areas as alloy solidification, crystal growth, biological separations, and chemical and fluid physics. NASA's Materials Processing in Space program has developed a variety of ground-based and flight facilities and experiment hardware to utilize the low-gravity environment and has invited industry to participate in joint investigations and projects.

In this concept for involving industry, the federal government and a private company agree to be responsible for specific portions of the research effort, and no funds are transferred between parties. The allocation of rights to resulting inventions and data is subject to negotiation between the parties for each effort undertaken.—PMB 32

# WINDSAT: Space Wind Sensor to be Tested

A new wind sensor system is being tested on a mesa north of Boulder, Colo., by a team led by Freeman Hall of the Wave Propagation Laboratory. If the tests are successful, a more advanced version of the system may be tried out late in this decade on the Space Shuttle. The system's utimate destiny would be aboard a proposed satellite called WINDSAT.

Global wind measurements are a vital but missing link in efforts to improve long-range weather forecasting. Present upper-air wind measurements, mostly by instrumented balloons, are too limited, and there is a need for an extended method.

The new wind sensing system is built around a laser radar that can gauge the speed with which winds are moving loward or away from it. Measurements come from the frequency shift of infrared beams reflected from wind-borne particles.

The system envisioned for WINDSAT would be able to measure the winds in layers spaced 1 km apart. The present version, in which the laser beam is projected by a mirror 25 cm in diameter, has a range of 20 km. The satellite version would have a mirror 1½ m in diameter and would be powerful enough to scan hundreds of kilometers. [Source: NOAA] \$8

# B.S. in P.E. = \$30K/Year

Earth sciences graduates can . . . [look] forward to long lines of would-be employers who will try to tempt [them] with high salaries, according to a report describing a new survey by the College Placement Council (*Industrial Research and Development*, July 1981). This survey of the job market reports that graduates with the bachelor's degree in the earth and physical sciences have been starting employment at an average salary of approximately \$22,000 per year. This figure amounts to an 18% increase over the average salary.

erage starting salary for the same groups a year ago.

Another important result is that some starting salaries for petroleum engineers (B.S. in P.E.), are upward of \$30,000 per year, which though not at all unusual, was the top starting salary group for 1981 college graduates. Inquelrial Research and Development points out that liberal arts gradu-

ates consider themselves to be fortunate if offered starting salaries of \$12.000 per year.

Petroleum engineers, and engineers in general, traditionally get the best offers; the increase in earth scientists' salaries is a notable exception this year. Many other fields are oversubscribed and overemployed. An example of a field that is now and has been in the past highly popular among employees is the field of computer science. The average starting salary this spring for computer majors was approximately \$20,000 per year, but this level constituted only a

relatively small increase over last year's starting salary.

As a group, engineers simply do better than any other group right out of college. As quoted from the College Placement Council's report (Spring, 1981), "63% of all the job offers at 161 colleges and universities surveyed by the Council went to engineers." Note though that the engineering majors from those universities made up only about 7% of the graduates.

## **Nation's Water Picture Brightens**

The nation's streams took a strong upturn during June, showing good recovery from the persistent dry trend of the previous months, although scattered pockets of below-normal flow were reported in parts of the Southeast and the West, according to a month-end check by the U.S. Geological Survey.

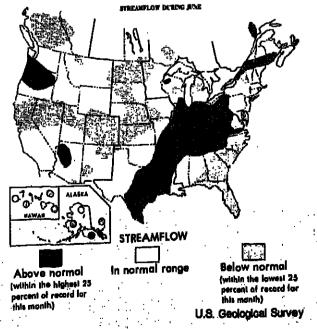
USGS hydrologists said that 30% of the 165 key index stations reporting across the country in June showed well-below normal streamflow (within the lowest 25% of record), a decided upward trend from May, when half of the index stations reported below-normal streamflow. Below-normal flows were reported in parts of 27 states during June, down from the 31 states that reported low flows in May.

The Southeast is, however, still severely affected by the long months of dry conditions. A band of persistent low flow exists from the Carolinas south to Florida and west through Georgia and Alabama. Flows on some streams in South Carolina have been in the lowest 25% of record now for six straight months. That is, 75% of the time, streamflow will be equaled or exceeded. All six of the key index stations in Florida reported below normal flows for June, the second consecutive month that all six stations have been below normal.

Strong recovery was noted from the Great Lakes Region south through Kenlucky, Tennessee, Arkensas, and most of eastern Texas, where streamflow was within the highest 25% of record for June.

Reflecting the general national improvement in June streamflow conditions, combined flow of the "Big Five" rivers (Mississippi, Columbia, St. Lawrence, Ohio, and Missouri) averaged 1261 billion gallons a day (bgd), 30% above normal and the first time in 7 months that the combined flow of the rivers has been above normal.

"Individual flows of the Big Five for June: Mississippl River near Vicksburg, Miss., 573 bgd, 50% above normal and a 48% increase from May; Columbia River at The Dalles, Ore., 302 bgd, 2% below normal but 20% above last month; St. Lawrence River near Massena, N.Y., 164 bgd, 3% below normal but 2% above last month; Ohio River at Louisville, Ky., 147 bgd, 270% above normal and 32% above May; and the Missouri River at Hermann, Mo., 75 bgd, 6% above normal and 8% above May. (Photo credit: U.S. Geological Survey, Department of the Interior.)



# Keyworth Reflects Reagan Policy

George Keyworth, new presidential science advisor, revealed what may be the elements of a new approach to the support of scientific research in the United States. Keyworth gave his first major address at the recent Research and Development Policy Seminar held in Washington under the sponsorship of the American Association for the Advancement of Science (AAAS). The United States must be prepared to relinquish its leadership position in some areas of scientific research, he stated. The U.S. will focus its science toward assuring that the country is second to none in military might.

Keyworth stressed that the Administration's proposed budget provides funding needed for support of the "hard" sciences. He made the point that this country can no longer afford to maintain a leadership role in the broad spectrum of sciences, but instead must be selective. He appeared to divide the federal government's future funding support in science between the areas of pertinent and promising science and the disciplines that support technology, both industrial and military. The "pertinence" was in relation to prevailing national requirements. The "promise" was in reference to his conviction that the "payoff" of basic research could not be expected for upwards of 10 years after a grant had been awarded.

Like his predecessor in the directorship of the Office of Science and Technology Policy, Keyworth sees his role not so much as an advocate of the sciences, who has the President's ear, but as more of an advisor, a setter of priorities

Although the main thrust of Keyworth's speech was that the country's preeminence in scientific research was to be restricted to areas of science selected after careful review, he did not indicate support of any standard less than one of excellence. Some fletds would simply have to be abandoned, but those supported would have to be of convincingly high priority. He gave the widely held opinion that pumping more and more funds into an area of research, even one of high priority, is a process that succumbs, eventually, to the law of diminishing returns. Support, therefore, is to be granted to essential programs, and even then, to a limited level.—*PMB* \$\infty\$

# **Geophysicist Obituary**

J. M. Burgers, 86, died on June 7. He joined AGU in 1956.

# **New Publications**

# Weather Modification by Cloud Seeding

A. S. Dennis, Academic. New York, xv + 267 pp., 1980, \$29.50.

# Reviewed by Charles L. Hosler

This book accomplishes its stated purpose of providing information on cloud seeding to upperclassmen or graduates of university programs in the physical sciences or engineering, and I would recommend it to them as a quick and painless way to become conversant with what cloud seeding is all about. The book may discourage an even larger audience of nontechnically oriented cloud-seeding enthusiasts or seekers of knowledge by the omission of a paragraph or two of a more elementary and descriptive treatment of processes such as nucleation, cloud formation. and precipitation formation at the beginning of the chapters treating those topics. The nine chapters cover an introduction, which includes a brief history and context for cloud seeding; 'Atmospheric Aerosol'; 'Formation of Clouds and Precipitation'; 'Concepts and Models for Cloud Modification'; Generation and Application of Silver lodide Crystals and Other Seeding Agents'; Statistical Evaluation of the Results of Cloud Seeding'; 'The Modification of Fog, Snow, and Rain'; 'Suppression of Weather Hazards'; and 'Impacts of Weather Modification on Society.' All of these chapters are brief and to the point. The elaboration that many of those familiar with the topics treated might seek or feel necessary for completeness would have turned the book into something the author did not intend it to be.

The readers seeking a quick answer as to whether or not cloud seeding is the answer to their concern in a situation where they need rain or want to prevent or promote some weather event will be disappointed. There is no formula to apply or table or graph that will help to decide. This is as it should be because the answers are not that easy to determine, even by the experts. The reader seeking that information will probably conclude that he needs expert advice and that also is as it should be. The general physical knowledge and the information on the potential for weather modification through cloud seeding available in this book will place the person seeking advice in a position to at least ask the right questions.

There is a persistent tendency on the part of nonmeteorologists, supported by some early claims by cloud seeders, to presume that weather over the whole country or even global weather can be altered by local or regional seeding. Thus, the reviewer would have preferred a stronger case be made for the lack of a physical basis for expecting cloud seeding to affect the overall development of wave cyclones and large-scale synoptic features. The casual reader may miss the brief freatment stating that we have no hypothesis to support this type of modification. This should have been backed up by the reasons one would not expect such modification.

This is a useful book by a knowledgeable author that should find its way onto the bookshelves of college teachers and technically oriented users or potential users of cloud seeding. For those interested in extensive examination of the subject, it is a good starting point.

Charles L. Hosier is with the Department of Meteorology. Penn State University, University Park, Pennsylvania. Geodesy

W. Torge, Waller de Gruyler, New York, xi + 254 pp., 1980, DM 48.

Reviewed by K. P. Schwarz

The book is a translation of a well-known German textbook on geodesy, which has been widely used since its publication in 1975. On occasion of this translation it has been revised and thus includes developments to about

The book is subdivided into the following sections: Introduction. The Gravity Field of the Earth, Geodetic Reference Systems, Methods of Measurement in Geodesy, Global Geodesy, and Geodetic Surveying.

The introductory section reviews briefly the definition, historical development, and organizational structure of geodesy. The second section discusses the components of the gravity potential, level surfaces, and plumb lines, the representation of the geopotential by spherical harmonics, and time variations of the gravity field. The third section introduces global and local astronomic and terrestrial frames and relates them to the reference surfaces defined by the actual and the normal gravity field. The fourth section treats astronomic, satellite, and terrestrial positioning methods as well as the measurement of absolute and relative gravity. The fifth section deals with the problem of determining a global representation of the gravity field by astrogeodetic,

gravimetric, satellite, or combination methods and discusses some implications for the structure and dynamics of the earth. The last section, somewhat of a misnomer, gives an introduction into horizontal, vertical, and gravity net-

The strength of Torge's Geodesy is its conciseness and good organization. The whole material is presented on 254 pages with sections 4 and 5 taking about two thirds of the space. The price for this conciseness is the absence of detailed derivations. In general, only major steps in the development are given, and often one has to be content with the final formula. The author has added, however, an extensive bibliography and has cross referenced the text with great care. The interested reader can thus go back to source information, although a knowledge of German besides English is mandatory in this case. The presentation shows a good balance between the mathematical formulation of a problem and its descriptive explanation and thus provides the reader with a clear ofclure of the fundamentals and the techniques presently used in geodesy.

in summary, the book presents the body of geodetic knowledge in a well-organized form and formulates the main problems and solution approaches in a concise and careful manner. It is therefore welcome in a field where good textbooks do not abound. It is recommended as an undergraduate text for geodesy courses but will also serve the geoscientist who wants an up-to-date presentation of the field without a detailed discussion of current research

The excellent quality of printing and graphics reproduc tion as well as the smooth translation of the original lext add to the attractiveness of the book.

K. P. Schwarz is with the Division of Surveying Engineer. ing, University of Calgary, Calgary, Alberta, Canada,

# New Listings

Items listed in New Publications can be ordered directly from the publisher; they are not available through AGU,

Space Science Comes of Age: Perspectives in the History of the Space Sciences, P. A. Hanle, V. D. Chamberkin (Eds.), Smithsonian Institution Press, Washington, D.C. xiil + 194 pp., 1981, \$12.50 (paper), \$22.50 (cloth) Statistical Treatment of Environmental Isotope Data in Precipitation, Tech. Rep. Ser. 206, International Atomic Energy Agency, Vlenna, Austria, xx + 255 pp., 1981,

The Economics of Irrigation, I. Carruthers and C. Clark, Liv. erpool University Press, Liverpool, England, xviii + 300 pp., 1981, £20.00.

The Inaccessible Earth, G. C. Brown and A. E. Mussell A len & Unwin Inc., Winchester, Massachusetts, xii + 235 pp., 1981, \$41.00 (cloth), \$22.50 (paper).

The Magnetotelluric Sounding Method, A. A. Kaulman and G. V. Keller (Eds.), Elsevier, New York, xiv + 596 pp. 1981, \$144.00.

# AGU Awards

The Twentieth Presentation of the James B. Macelwane Award

Ronald J. Prinn, David Southwood, and Donald J. Weidner

in recognition of significant contributions to the geophysical sciences by a young scientist of outstanding ability





## Citation to Prinn

Mr. President, ladles, and gentlemen: We are honoring tonight a young scientist who combines an unusually broad knowledge of the chemistry and dynamics of planetary atmospheres with a healthy skepticism regarding established dogma and a marvelous ability to shrug off the displeasure of established dogmatists.

Ron Prinn's theoretical research has significantly influenced our understanding of the terrestrial stratosphere as well as the atmospheres of Venus and Jupiter. Since 1980, when he joined the Department of Meteorology at Massachusetts institute of Technology, he has been a leading participant in collaborative efforts to develop numerical models of the stratosphere combining comprehensive chemistry with realistic dynamics. Such models have been a rich source of controversy in our continuing efforts to predict man's potential impact on the ozone layer. Prinn's work on the chemistry of sulfur gases in the atmosphere of Venus, published in 1973 and 1975, foreshadowed the explosive growth of interest in the sulfur chemistry of the terres-Itial almosphere. By delimiting conditions for the predominance of either sulfur or sulfuric acid in the clouds of Yenus, his work provided a basis for the interpretation of Foneer Venus data. It was Prinn who suggested that the spectacular dark markings on ultraviolet images of Venus are caused by sulfur. More recently he has discussed the contribution of phosphorus to the color of the Great Red Spot on Jupiter. Not forsaking the mother planet, he is currently engaged in efforts to determine from field measurements whether there is any truth in the well-established theory that freon, methyl chloroform, and nitrous oxide are

Mr. President, it is a privilege and pleasure to present Ronald G. Prinn for the James B. Macelwane Award.

chemically inert in the troposphere.

James C. G. Walker and Raiph J. Cicerone

Thank you Jim for your very kind citation. I am flattered to be joining the distinguished list of previous recipients of the Macelwane Award. It is also a delight to be referred to as young again. Back when I was really young, I regarded people over 30 as definitely middle-aged. My work has required me to delve into more than one area of specializafon, Fortunately, as I have wandered through the disciplines of meteorology, atmospheric chemistry, and planelary science, I have been treated with mercy by the Messionals in these areas. Perhaps this is because the meleorologists think I am an atmospheric chemist, the atmospheric chemists presume I am a planetary scientist, and the planetary scientists see that I am in a meteorology arlment and my true profession must therefore be Weather forecasting. However, I see that the awards comnitiee contains representatives from all three of these disciplines, so I must be immune from such a rib at least for

Any recognition coming my way this evening must in fact be shared with a number of unselfish friends, collaborators, and collaborators. and colleagues. Let me take this opportunity to mention a lew of these people who have influenced my directions in beneficial ways. John Lewis managed to entice me away from a career in molecular quantum mechanics and showed me that speculation can be an occasionally respeciable vocation. Norman Phillips successfully guided me this the then largely allen environment of meteorology and was instrumental in the formulation stages of the stratospheric model, which Jim has mentioned. My collaborators in this modeling work, Fred Alyea and Derek Cunnold, have done a large part of the day-to-day work on the model and, in addition, are my collaborators in the fluorocarbon lifetime experiment, which has also been mentioned. Don Hunten has been burdened with refereeing an unseemly number of my publications and has been blunt when necessary and encouraging when needed. Gerry Wasserburg showed me by example that scientists should be actively involved in the occasionally thankless task of guiding and advancing their fields, and not merely reap the benefits of others' efforts in lhese endeavors.

The citation of my work in planetary atmospheres carries particular pleasure. It has frankly been a joylul task to explore the photochemistry of apparently exotic atmospheric species such as hydrogen chloride, carbonyl sulfide, phosphine, and thiozone. It is also my belief that research in planetary atmospheres can and has had important implications for our own atmosphere, in addition to having its own intrinsic fascination. I sincerely thank President J. Tuzo Wilson and the Amer-

Ican Geophysical Union, and in particular the Macelwane Awards Committee, chaired by Gerry Wasserburg, for this unexpected yet gladly accepted award.

Ronald G. Prinn

## Citation to Southwood

tt is indeed an honor and a pleasure for me this evening to introduce to you one of the recipients of the Macelwane award, Dr. D. J. Southwood of Impenal College, London. England. This award is presented annually by the American Geophysical Union for outstanding contributions by a young scientist. It is very fitting that David be selected this year.

David, a British citizen, was born in Torquay, England, in 1945. Mothers of small children take heart. According to David's mother he did not utter his first words until after the age of two. However, he has not been at a loss for words since. Shortly thereafter he entered Queen Mary College in London. Later he became a postgraduate student under Professor J. W. Dungey at Imperial College, under whom he wrote a thesis entitled 'Theoretical Studies of ULF Waves in the Magnetosphere,' receiving his Ph.D. in 1964.

Shortly after graduation, David spent a year at UCLA, continuing his work on magnetic pulsations and, on the side, teaching me much of what I know about the underlying physics of the magnetosphere. After his stay at UCLA he returned to imperial College as a lecturer, but David soon got itchy feet again. However, since then he has usually satisfied his urge to travel by almost annual summer visits to the U.S. We at UCLA have been fortunate enough to have him join us five times in the last 10 years.

David's initial contribution to magnetospheric physics was a theoretical and experimental investigation of the Kelvin-Helmholtz instability at the magnetopause. He later looked at wave-particle resonances within the magnetosphere and their effects on cross L diffusion. Together with his student, W. J. Hughes, he examined the effect of the ionosphere on magnetic pulsations and brought order and comprehension to an otherwise confused situation. Together with Margaret Kivelson of UCLA he examined the effects of electric fields on magnetospheric particle motion and, in particular, aided ng of the physics of particle injection into the magnetosphere. Most recently he has been putling order into our understanding of the way in which the Galilean satellite to interacts with the Jovian magnetosphere.

I can't help remarking as I did here several years ago (Eos, 58, 872-873, 1977) that having a name in the latter half of the alphabet helps one to win the Macelwane award. However, David's deceptively simple name has also led him on occasion to gain less credit than he deserves. Recently, for example, he was referenced seven limes in a paper as Southward (Geophysical Research Letters. 7. 881-884, 1980). On another occasion a proposal was sent into NSF with his name on the cover written as Smallwood. Perhaps tonight's ceremonles will help us remember David's real last name.

I would like to close this introduction by reading the citation prepared by the awards committee [and] which vary accurately summarizes David's contributions to date.

Over the last 14 years, David Southwood has substantially advanced the application of magnetohydrodynamles to space plasmas and, particularly, to the earth's magnetosphere. His Ph.D. thesis on the Kelvin-Helmholiz instability at the boundary of the magnetosphere was a landmark in the field. Over the last decade, he has become perhaps the leading expert on the theory of magnetohydrodynamic waves in the magnetosphere. He has made a substantial contribution to the

theories of magnetic-field-line resonance, of the generation of magnetic pulsations by the Kelvin-Helmholtz instability, and of the influence of the ionosphere as a boundary condition on magnetohydrodynamic waves. In general, his research was a major factor in the theoretical developments needed for the interpretation of the last decade's increasingly sophisticated space- and ground-based observations of 'geomagnetic micropulsalions.' He has also worked actively and productively in other areas of space plasma physics. By means of clever but simple calculations, he has contributed significantly to the theory of large-scale plasma motions in the earth's magnetosphere and, particularly, to the understanding of the transport of particles into the ring current and the Van Alien belts. This work on the earth's magnetosphere, and also his very recent work on the interaction of to with Jupiter's magnetosphere. has been characterized by creativity, by clear intuition, by deep understanding of physics, and by the precious ability to bring theory into effective contact with obser-

Christopher T. Russell

I am very honored to receive this award, and in spile of the citation you have just heard I think my ability has been to be in the right places and to work with the right people.

At Imperial College I work with two close colleagues, Jim Dungey and Stan Cowley, without whom I would not be here. I have worked with Jim since my postgraduate days, and one thing I am indebted to him for is converting me from a mathematician to a physicist, something I have not

There are large numbers of people I have worked with at UCLA. I shall single out Margaret Kivelson for mention. It is good to work with a clover colleague, even botter if she has shared attitudes and complementary skills. I have also noticed she is charming and attractive and a stickler for correct use of grammar.

I have one unusual working relationship. My mother works in the same group as me. We have more or less worked out who works for whom. Though widowed when I was quite young, she successfully raised me and my brother. Late in life she started a technical education only to end up working in the same place as both her sons.

Another close relative to whom I owe a great deal is my wife, Sue, who has divided her attention between activities such as raising our three children. Anna. Michael, and Peter, and ministering to me more than I deserve, but also including setting up her own business and involvement in a variety of outside interests.

There are lots of other people who should share some of my glory. I cannot name them all, but I am aware that a very large fraction are American. Probably all Europeans speculate at some time on the American they might have been. I worked here enough to know, and I have had a fair immersion in American values. I am not original in pointing out values are often hilanously the opposite of my native British ones. Sincerity (or boring seriousness) is an American virtue. Cynical wit (or flippant insincerity) is a prized British social skill. I am busy cultivating a happy schizophrenia where I accept both sides. In particular I like American enthusiasm for hard work and your optimism about change. These latter attitudes make for a dynamism in U.S. science I have always found exciting. Thanks to you all for

Finally, let me say something on the virtues of travel. It broadens the mind, challenges the digestion, cements collaboration, helps international understanding but, unfortunately, costs money. I would like to thank the several funding agencies and grant-awarding bodies in the United Kingdom, United States, and elsewhere who have helped me to travel. Was it not a scientist who said. 'If I have traveled further than most, it is because I have been the holder of

David Southwood

# Citation to Weldner

Mr. President, ladies, and gentlemen: I have the pleasure the development of the Brillouin scattering method of measuring elastic moduli of minerals. Shortly after joining the faculty of the Department of Earth and Space Sciences at Stony Brook, New York, in 1972, he became interested in Brillouin scallering and started to build a research tab for the application of Brillouin scattering to the investigation of elastic properties of minerals. He recognized the value of the technique in making measurements on very small samples, a capability that makes it particularly attractive for examining quenched high-pressure phases and other eamples that are available in very small sizes. In the short time since he established his lab, he and his colleagues and students have made measurements on many important rock-forming minerals and have reported the results in a number of excellent professional papers. In many cases the measurements were made on tiny specimens which are barely visible to the human eye and whose elastic procertles could not have been measured in any other way. Concurrent with this work, he has continued his studies in selsmology as well as [his] theoretical investigations [into] the elastic properties of crystals.

The development of a new technique and its application to the acquisition of data that would otherwise have been. unobtainable is a big challenge. The success of Donald J. Weidner in this endeavor attests to his exceptional abilities. as a scientist.

Classified EOS offers charafied space for Positions

Available, Positions Wanted, and Services, Supplies, Courses, and Announcements. Then are no discounts or commissions on classified ads. Any type that is not publisher's choice is charged for at display rates. EOS is published wholkly on Tuesday. Add must be received in writing on Monday 1 week prior to the date of the rssue required

Regiles to ads with box numbers should be addressed to Box American Geophysical Union, 2000 Florida Avenue, N.W. Washington. POSITIONS WANTED

1-5 times-\$1.00, 6-11 times-\$0.75.

12-26 times -\$0 55 POSITIONS AVAILABLE 1-5 times-\$2 00, 6-11 times-\$1 60, 12-26 times-\$1 40

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS 1-5 kmes-\$2.50, 6-11 limes-\$1.95,

12-26 times-\$1.75 STUDENT OPPORTUNITIES For special rates, query Robin Little, 800-424-2488

# POSITIONS AVAILABLE

Visiting Scientist Position The Joint Institute for the Study of the Atmosphere and Ocean, University of Washington. Visiting or physical oceanography and interests in dynamical and or geochemical aspects of climate variability. Term of appointment, one (1) year, renewable for a second year subject to the approval of the Council Closing date: September 15, 1981. Send curriculum vitee and a brief research prospectus to Director, JISAO, c.o Department of Almospheric Sciences, AK-40, University of Washington, Seattle.

An equal opportunity affirmative action employed

Almospheric Scientist Group Head. Sen-or stall scientist position available immediately at the NAICs Arec to Observatory. The successful appli-Sciences Group and will be expected to lead that the Arec to facilities A Ph.D. degree in atmosp ic or physical sciences or radar engineering and a record of solid research accomplishments are required. Expensence with radar studios of the strato

sphere, mososphere, and lonosphere or with HF modifications of the fonosphere is desirable. Salary Open Please send resumo and names of at least hree references to Dr. Harold D. Graft, Jr., Director, Arocibo Observatory, Space Sciences Building, Comell University, Ithaca, New York 14853, NAIC Cornell University are EOE/AAE.

Physical Oceanographer. A postdoctoral re search position in physical oceanography is available at the University of North Carolina at Chapet Hill, to begin as early as August 1981. Ph.D.'s with background and interests in mososcale Gulf Stream dynamics, geophysical fluid dynamics, or ocean acoustics are encouraged to apply. Initial apcontraent will be for one year with a possible continuation through a maximum of three years. Please send vitre and the names of three references to Prolessor John M. Bane, Morine Sciences Program, 12-5 Venable Hall 045A. University of North Carolina, Chapel Hill, North Carolina 27514. The University of North Carolina is an affirmative

University of Hawaii/Faculty Positions. The Department of Geology and Geophysics and the Hawaii Institute of Geophysics have openings for the 1981-1982 academic year. Rank is open de-pendent on qualifications. We are seeking persons who will participate to our teaching and research program in any of the following areas: (1) structural geology and marine tectorics: (2) hydrology and engineering geology; (3) marine selamology, magnetics, and gravity. To apply send a letter of interest, a current vita and 3 letters of reference to Dr. S. O. Schlanger, Chairman, Department of Geology and Geophysics, University of Hawali, 2525 Correa Road, Honolulu, Hawaii 96822 (808-948-7826), or Or. C. E. Helsley, Director, Hawali Institute of Geo-physics, same address (808-948-8760). Open until litted.

action equal opportunity employer.

The University of Hawati is an affirmative action and equal opportunity employer

Research Associate in Physical Oceanogra-phy. Applications invited for a 12 month position as Research Associate in the School of Oceanog-raphy, Oregon State University. Ph.D. in physical sciences. Must have demonstrated ability to ana-tical consequence of the property of the translyze oceanographic data, preferably data from small-scale turbulence experiments.

Appointee will be expected to cooperate in the analysis of oceanic microstructure data. Salary:

\$22,000. Submit application and names of three references by 31 August 1981 to:

Douglas R. Caldwell
School of Oceanography
Oragon State University OSU is an affirmative action equal opportunity

Polar Oceanographer/See Ice Dynamicist. A position is available under the intergovernmenta Personnel Act of 1970 for persons now employed in State/local government or in colleges and universities. This position is located within the Oceanic Processes Branch of the Environmental Observation Division of the Office of Space and Terrestrial Applications, NASA Headquarters. The position is for one year, with the possibility for renewal for an onal year. Pay will be at a level commensurale with experience, and will be established after a review of qualifications.

Candidates must have been employed by the university in a permanent position for at least 90 days or be a career employee of a State or local government. Candidates must also meet the Federal qualification standards for the position. These are as follows: a degree in an appropriate field of serious plus through the position. acience, plus three years of progressively responsi-ble experience in duties related to the position. This individual will be responsible for planning, developing, and implementing a scientific research program in satellite remote sensing of oceanic pro-cesses in polar regions. A background in polar cesarography, sea ice dynamics, or a closely-relat-ed field is required; experience in remote sensing, although desirable, is not essential. A Ph.D. or equivalent training and experience is mandatory.

Interested parties should send a current resurne to NASA Headquarters. Attn: Mrs. Catherine Zegowitz, Code EPM-3, Washington, D.C. 20546. Selection for this position will be made from otherwise eligible candidates without discrimination for any nonmerit reason such as race, color, religion, sex, national origin, politics, marital status, physical handicap, age, membership or nonmembership

an employee organization, or personal levoritism. Electron Microprobe Technical Specialist/ University of Colorado. The department of Geological Science, University of Colorado, Boutder, seeks a person who will assume responsibility for the department's electron microprobe laboratory. Duties will include day-to-day operation of our MAC 400 microprobe equipped with a KEVEX EDS system, instruction of new operators, maintenance of the microprobe as well as other X-ray equipment within the Department, microprobe software and hardware development, and participation in research projects involving stilicate, suifide and oxide mineralogy. The job requires either a degree in electronic or electrical engineering, or two years of technical experience utilizing electronic instrumen-tation associated with an electron column instrument. An individual with an M.S. degree in Geology and microprobe experience will be considered highly desirable. Salary ranges from \$20,000—\$25,000 depending on experience. Please send, by August 15, letter of application and resume to Bruce Badder Parsonnel Desartment ger, Personnel Department, University of Colorado,

1511 University Avenue, Boulder, CO 80309. The University of Colorado is an equal opAcouatical Physicist. Physics and Chemisir Department of Naval Postgraduate School (NPS). n Monterey, California, seeks applicants for tenure track position at assistant or associate professor level, physicist who has experience and interest in ning and research in area of acoustics. Prin mission of NPS is advanced education of Naval Of ficers. Department offers M S. and Ph.D. degrees In Physics and Engineering Acoustics with major emphasis on Master's degree program. Most acoustics teaching is at senior and graduate level date must have Ph.D., be effective teacher and be interested in and capable of engaging in researc Current acoustics research areas: ocean acoustics Including propagation, ambient noise, scattering and diffraction; propagation in tapered wave-guid acoustic imaging; signal processing and non-linear acoustics. Send resume and references to Prol. O. B. Wilson, Department of Physics and Chemis try, Naval Postgraduate School, Monterey, CA

Affirmative action/equal opportunity employer

Geohydrology/Geochemistry/Econom **Geology.** Applications are invited for a one year appointment effective August 19, 1981 to teach undergraduate courses in introductory geology and elements. ther geohydrology, geochemistry, or economic geology. Ph.D. preferred but will consider ABD. The position will be reannounced in September 1981 as a tenure track slot at the assistant professor level with teaching and research duties about 50/50. Applications including resume and names of three references on building resume and names of three references. erences should be sent to W. D. Gosnold, Jr., Department of Geography-Geology, University of Nebraska at Omaha, Omaha NE 68182. An AA/EO employer.

# STUDENT OPPORTUNITIES

Meteorology and Physical Oceanography
Assistantships. Research assistantships for graduate students in meteorology and physical oceanography are available from The Floride State University. Research topics may cover atmospheric dynamics, physical meteorology, synoptic meteorology, climatology, numerical weather prediction, physical oceanography, chemical oceanography, coean modelling, satellite oceanography and geo-

physical fluid dynamics. Appointments are half-time and offer salaries up to \$10,500 per year. Beginning graduate students may be offered salaries as low as \$7,200. Students with undergraduate degrees in physics, chemistry and engineering are encouraged to apply.

Additional information may be obtained from Dr.

James J. O'Brien, Mesoscale Air-Sea Interaction Florida, 32306.

# AGU

Highlights: Spring Council Meeting

Council members present at the May 24, 1981, meeting were Keilt Aki, Steven Burges (for Jim Wallis), Peter S. Engleson, E. R. Engdahl, Charles E. Helsley, James R. Heinzler, Carl Kisslinger, Leslie H. Meredith, Chris N. K. Moders, Norman F. Ness, Marcia M. Neugebauer, James J. O'Brien, Richard Rapp, Carl Sagan, James C. Savage, Joseph V. Smith, Fred Splinaus, Donald L. Turcotte, James A. Van Allen, J. Tuzo Wilson, and Jay Winston (for Elmar R. Reiter until his arrival at 6:50 P.M.). David Strangway, representing the Canadian Geophysical Union, and Peter Steinhauser, representing the European Geophysical Society, were special observers at the meeting. Council meetings are open, and a number of section secretaries, committee chairmen, journal editors, and other members atlended. The following major actions were adopted by the

The experiment of publishing oceanography and lower-

atmosphere papers in JGR Green issues alternate to those containing upper-almosphere papers will be continued through 1982. From preliminary indications the experiment seems to be working, but a full year of data, including a renewal cycle, is needed to assess the success of the experiment. Final decision will be made prior to the 1983 dues

Publication of a bimonthly journal devoted to lectonics will begin in 1982. Because there will be no page charges, the journal will be strictly limited as to the number of pages published annually. Printing will be from author-supplied copy. The outline of this proposal was given in the editorial column of the April 7 Issue of Eos.

The AGU Congressional Science Fellowship was continued for 1982-1983. In discussion of this issue it was noted that congressional staffing tends not to include scientists, and therefore science is not represented in the congressional committees. AGU participates in the AAAS Congressional Fellowa Program.

Participation in the AGI (American Geological Institu Minority Scholarship Program was continued through the 1982–1983 school year. The program has attracted many proof and scholarship program has attracted many proof and scholarship. good applicants. Applicants funded by the AGU confilm are designated AGU scholars.

The sections accepted the responsibility for accepted nominations for AGU fellows. It was thought that in the applicants will be applied to the property of the pr applicants will be considered first by those most family Touche Ross and Company was selected again as act with the field. •

auditors for 1981. A \$10,000 contribution was approved as seed more

planning a series of films in the geophysical sciences.

National Academy of Sciences is investigating the post ty of provide the post planning the post pla ty of producing a new series along the lines of trose pour duced after the IGY if the films go into production. Adu will be listed among the sponsoring organizations had in The annual business meeting of the Union was had in mediately after the adjournment of the Council mediate.

ANTON L. HALES SYMPOSIUM

The Geosciences Program of The University of

"SOME RECENT ADVANCES IN

**GEOPHYSICS"** 

on October 5-6, 1981, in honor of Dr. Anton L. Hales

The Symposium will consist of two days of invited

talks by internationally known speakers from acade-

ics with an emphasis on seismology. Topics will in-

clude recent COCORP results, modelling reflection

ation of seismic waves, and global tectonics.

seismograms, heterogeneous earth structure, attenu-

For additional details and registration information.

contact Richard M. Mitterer or Ronald W. Ward, Pro-

grams in Geosciences, The University of Texas at

Dallas, P.O. Box 688, Richardson, Texas 75080.

mia and industry on recent developments in geophys-

on his 70th birthday.

Telephone: 214-690-2401.

Texas at Dallas will sponsor a Symposium entitled

Donald Weidner is not only an accomplished scientist but a person who has already guided and inspired a number of promising younger scientists to begin careers in seismology and solid state geophysics. Mr. President and officers of the Union, I present Donald J. Weidner for presentation of the 1981 Macelwane Award.

Thomas J. Ahrens

## Acceptance

Thank you Tom for your kind remarks. I also thank the American Geophysical Union for honoring me with this

This award is particularly gratilying to me insomuch as it relates to a lew aspects of my ille. Every morning when I confront the mirror I discover that my forehead has made yet another advance on my hairline. Even worse, those taller than I tell me that my forehead is about to conquer the very top of my head. I find my joints groaning as I do simple tasks. Graduate students are now handly trouncing me at squash. I look across the campus and ask who are these children, only to find out that they are the graduating class. With all of these observations at hand, I cherish the part of the Macelwane citation which reads "young scien-

I am also very gratified by the recognition of my research given by this award. As I am sure is true of most of this audience, there have been many hard hours late at night, many frustrations, and a few successes. There are times when we wonder if anyone cares about what we're doing. There are times when we question if we shouldn't be doing something else. The monetary rewards associated with a faculty position are traditionally small. It is under those circumstances that an award such as this one serves to renew one's vigor.

But, in the final analysis we realize that we do not pursue science for the awards or personal recognition. As the physicist, mathematician, philospher Henri Poincaré once said, 'The scientist does not supply nature because it is useful: he studies it because he delights in it, and he delights in it because it is beautiful.' Clearly we hope that our results may be useful to others, but it is the beauty of nature and the excitement of discovery that drives us and not the pursuit of awards.

If Sir Isaac Newton 'stood on the shoulders of glants,' I stand as a dwarf among giants. Many people have helped me personally and professionally. Foremost, is my wile, Deborah, who has cheerfully helped and supported me both in the easy times as well as the hard ones. My brother Jerry showed me by example how a scientist should think. My advisor, Kei Aki, nurtured me at a young age and aided my development. Graduate students at Stony Brook both contributed to my research program and provided water from the fountain of youth. In particular, I wish to acknowledge Michael Vaughan, Alan Kalka, Jay Bass, and Andy Au. The institution of Stony Brook and my colleagues in the Department of Earth and Space Sciences have provided an almosphere of stimulation, collaboration, and when necessary, equipment that has allowed my research program to advance. The National Science Foundation has been generous in their support. To all of these I am grateful.

Since learning that I was to receive this award I have, on many occasions, considered relusing it. One such time was when I had to prepare this speech. Awards such as this come with many liabilities. University administrations often equate recognition of achievement with administrative ability; the result being a quantum increase in university committee work. One's colleages auddenly become more critical of the research program and question why the AGU committee ever chose this one to receive an award. More importantly, however, such an award brings more responsibility. The recipients must now live up to the honor that they receive. I am awestruck when I read the names of previous recipients of the Macelwane award. The tradition of accomplishment that they have set since receiving this award is intimidating, and living up to this tradition is truly a great challenge. I am honored to have my name listed along with theirs, and in the spirit of accepting this challenge, I gratefully accept the Macelwane award.

Donald J. Weldner

# Sponsors of 1981 New Members

Two hundred lifty-nine new members were elected between May 1 and June 30, 1981. The AGU members who sponsored them are listed below.

Three Members: Alan R. Bandy, Richard L. Carlson, Neville L. Carter, H. W. Dosso, R. E. Horita, Gerard Lachapelle, Peter J. Maroulis, Lawrence A. Taylor.

Two Members: Bruce A. Bolt, Kevin Burke, Chen-Tung Chan, David M. Christle, Raiph J. Cicerone, Jacques W. Delleur, John F. Dewey, H. P. Eugster, R. Allan Freeze, Kazuya Fujita, G. D. Garland, Robert Geller, Hugh C. Heard, Mark H. Houck, Florian K. Lehner, Bruce D. Marsh. David W. McGrail, Ronald T. McLaughlin, Harry Y. McSween, Mario J. Molina, Peter Molnar, Marie Morisawa James R. Rice, Gerald Schubert, K. P. Schwarz, George F. Sharman, A. K. Sinha, John M. Sinton, John C. Stormer, Jr., Francisco Suarez, T. E. Unny, Rob Van der Voo, David R. Veblen, James A. Whitney, David V. Wiltschko, Derek

One Member: Maha Abdalla, Sunit Kumar Addy, Thomas D. Ailken, James Iwan David Alexander, Raymond Anderson, Raymond E. Arvidson, Larry P. Alkinson, Milo M. Backus, Anloine Badan-Dangon, Samuel J. Bama, Aaron Barnes, Larry Barrows, Douglas R. Baumgardt, John W. Beicher, James P. Bennett, Jonathan H. Berg, Robert A. Berner, Robert L. Bernstein, Glenn O. Bertiaux, N. K. Bewtra, Kevin T. Biddle, Selena Billington, Jackson O. Blanton. James G. Blericos, W. Frank Bohlen, Stephen L. Bollvar,

W. F. Brace. Rafael L. Bras, David A. Brooks, Larry D. Brown, Robert C. Brown, Roger G. Burns, Peter Buseck,

Douglas R. Caldwell, Malcolm J. Cambell, Philip A. Candela, G. R. Carlonan, Richard W. Carlson, Robert F. Carlson, Robert S. Carmichael, Chalon L. Carnahar, Roy Carpenter, Edward Chang, Richard L. Chase, David Chavez, Abraham H. Chen, Garry K. C. Clarke, Lawrence Colln, Bastlaan Jacob Collette, Jim Constantz, Bruce H. Corliss, Peter Cornillon, Allan V. Cox, Patrick A. Crowley, C. Cunnane, Paul E. Damon, James F. Daniel, Khirod C. Das, Geffrey F. Davies, John N. Davies, Paul Davis, Richard W. Davis, David R. Dawdy, Roland A. de Szoeke, Anthony Charles Delany, Steven R. Dickman, Robert S. Dietz, S. Lawrence Dingman, Richard Ditteon, Janet A. Docka, John H. Doolittle, John J. Dowling, John J. Drake, Al Duba, Fredrick Duennebler, Timothy Durbin, William B. Durham, Rob-

Peter S. Eagleson, Stephen Ehrenberg, Leo M. Elsel, Robert M. Elila, Brooks B. Ellwood, Terry Engelder, Irene M. Engle, Albert J. Erickson, E. J. Essene, J. R. Evans, David Fahlquisi, Donald Farley, Gerald L. Feder, Michael Fehler, William C. Feldman, Myron B. Flering, Erlk G. Finnstrom, Harold Carlton Fitz, Jr., Donald W. Forsyth, Edward A. Frankovic, Carl Fricke, Cliff Frohlich, Yoshio Fukao, Aninony F. Gangi, Douglas H. Garbin, Michael O. Garcia, George Donald Garlick, Joel R. Gal, John William Geissman, Walter Gekelman, Daniel T. Georgi, Joe Gettrust, Christoph K. Goertz, Fraser Gogg, Alan Goodacre, Sarah Goodin, John T. Gosling, Dennis Grady, James W. Granath, Norman K. Grant, Ronald Greeley, John P. Greenhouse, Eugene Greestadt, L. Trowbridge Grose, D. Gubbins, John H. Guswa.

Bradford H. Hager, Douglas A. Haith, Francis R. Hall, James M. Hall, Leo M. Hall, Stuart A. Hall, Donald R. F. Harleman, Gregory D. Harper, Trevor Neil Hart, Akira Hasegawa, Richard H. Hawkins, Stanley P. Hayes, James Fred Hays, Walter J. Heikkila, Donald V. Helmberger, John H. Helsdon, Jr., Jim Herring, Norman Herz, John B. Higgins, Joseph W. Hirman, Robert M. Hirsch, Eva J. Hoffman, John H. Hoke, Robert W. Houghton, Shih-Ang Hsu, Kenneth L. Hunkins, David Huntley, Violet Rosemary Strachan Hutton, Simon Ince, Mizuho Ishida, David D. Jackson, Wolfgang R. Jacoby, Raymond Jeanloz, A. I. Johnson, Peler Jumars, Glenn H. Jung, William A. Jury, Jack A. C. Kaiser, Douglas L. Kane, William M. Kastner, John Katsufrakis, Robert Kay, Elvin Keilso, Paul Kintner, Paul H. Kirshen, Peter K. Kitanidis, David M. Klumpar, Kenneth P. Kodama, Nicholas Kouwen, Stamatios M. Krimigis, Richard J. Kull-

Paul E. La Violette, Theodore C. Labotka, Antonio C. Lasaga, Charles Russell Lawrence, Lawrence A. Lawver, Tay-How Lee, Tien-Chang Lee, Shaul Levi, S. Benedict Levin, Edward R. Levine, Robert C. Lieberman, Marvin Lilley, Robert J. Lille, Thomas E. Lisle, Ivan Lissauer, S. W. Lohman, Marc Loiselle, Richard R. Luckey, W. C. Luth, Gregory A. Lyzenga, William D. MacDonald, Peter F. Mac-Doran, David C. Major, William V. R. Malkus, Jose Roberto Manzano, Quervain Marcel, George O. Marmorino, Philip Marsh, Edward A. Marlell, John C. Maxwell, Michael J. McEachern, Patrick S. McIntosh, Malcolm C. McKenna, Dan McKenzle, William F. McKenzle, Karen McNally, R. H. McNutt, Murray B. McPherson, Michael O. McWilliams, Ronald Mess, H. J. Melosh, Wendell W. Mendell, Richard P. Mied, Chester Miller, Gary L. Mills, Andrew S. Milman. Hitoshi Mizutani, Allen Moench, Erik Molio-Christensen, Eldridge Moores, Millett G. Morgan, Donald A. Morrison, Marshall E. Moss, W. R. Muehlberger.

Andrew F. Nagy, Michael T. Naney, T. N. Narasimhan, Donald R. Nielsen, Aharon Nir, D. Kirk Nordstrom, Dag Nummedal, Amos Nur, K. M. O'Connor, Jerry S. Olson, Peter Olson, Neil D. Opdyke, Marshall Orr, Harold D. Orville, Aaron J. Owens, Surendra Pal, Carl D. Palmer, James J. Papike, E. M. Parmentler, David K. Parrish, David F. Paskausky, Tsung-Hung Peng, Wayne D. Pennington, Mary Jane Perry, Alan R. Peterfreund, John A. Philpotts, Kathleen Poole, Thomas A. Polemra, Fredrick Prahl, Ronald G. Prinn, Edward L. Procyshyn, William A. Prothero, Jr., Philip D. Rabinowitz, Srinivas Q. Rao, Kenneth H. Reckhow, lan Reid, R. J. Renard, Sol Resnick, Ray T. Reynolds, Philip G. Richards, Randall M. Richardson, A. K. Richter, Robert E. Riecker, John K. Robertson, Edwin S. Robinson, Robert Robinson, Raymond G. Roble, Michael G. Rochester, C. K. Ross, John W. Rudnicki, Patrick J. C. Ryali.

Nadi Adeeb Saad, Robert A. Saar, Takao Saito, Yosiko Salo, Ulnch Schmidt, Janet A. Schramke, Steven J Schwartz, Harry E. Schwarz, Charles B. Sclar, Jon T. Scott, Donald R. Seely, Sandro Serra, Allen M. Shapiro Denis M. Shaw, Kunihiko Shimazaki, Charles H. Shuitz, David W. Simpson, Shri Krishna Singh, James R. Slack, Norman H. Sleep, A. P. Slootweg, Douglas Smith, Raymond C. Smith, Stuart D. Smith, J. Arthur Snoke, Bengt Sonnerup, Thomas W. Spence, Joseph J. Spigal, William A. Sprigg, P. Srinivasan, Jery Russell Stedinger, R. R. Steeves, Reiner L. Stenzel, Don Stlerman, Edward Stolper, Keith D. Stolzenbach, D. W. Strangway, Robert G. Strom, Willon Sturges, John S. Sumner, Klyoshi Suyehiro, Lynn

Ronald C. Taylor, Michael D. Teubner, Lawrence W. Teufel, Thomas M. Tharp, Friedrich Theilen, Dana Thompson, Jr., Kent W. Thornton, Robert Thunnell, George R. Tilton, Alfred Toennissen, Marsha R. Torr, Alian H. Treiman, Carl Christian Tacheming, Jan Tullis, Terry E. Tullis, Donald L. Turcotte, Amjad Urnori, Kenneth L. Verosub, J. Veverka, Thomas A. Vogel, Richard Vondrak, Joachim Voss. David Walker, Raymond J. Walker, Chi-yuen Wang, Wendell D. Weart, Thomas A. Weaver, John B. Weeks, Donald Weidner, Alan Welch, Erhardt P. Werth, Warren B. White, William B. White, Albert J. Williams, III, Douglas F. Willlams, Richard T. Williams, Clark R. Wilson, John W. Winchester, Donald U. Wise, George T. F. Wong, Teng-long Wong, Eric Wood, James Wright, Francis T. Wu, Klyohumi

# Travel Grants for IAGA and IAMAP Assemblies Awarded

AGU recently received from the National Science Foundation block travel grants for U.S. scientists to attend the Third Scientific Assembly of the International Association of Meterorology and Atmospheric Physics (IAMAP) to be held In Hamburg, Germany, August 17-28, 1981, and the Fourth Scientific Assembly of the International Association of Geomagnetism and Aeronomy (IAGA) to be held August 3-15. 1981, in Edinburgh, Scotland. The IAMAP proposal was cosponsored by American Meterorological Society.

A total of 54 scientists were funded with the two grants. and the scientists ranged in age from 26 to 71, with the average age of 42 for the IAMAP grant recipient and 39 for those receiving IAGA grants. Fifteen were from the eastern part of the country, 18 from the central part, and 21 from the west coast, including Alaska. Two students were among those funded, one from each grant.

There were 53 applicants for funds from the IAMAP grant. Of these, 33 were funded with average grants of \$775. Four will go to both the IAGA and the IAMAP meetings: Janet G. Luhmann, Knut H. Stamnes, David J. Sievenson, and Robert G. Roper. Others receiving grants to attend the IAMAP meeting are Richard A. Anthes, Susan K. Avery, Louis J. Battan, Alfred K. Blackadar, David W. Buchanan, Andre A. Doneaud, Kerry A. Emanuel, Claude J. Frankignoul, Michael Garstang, David D. Houghton, Barry J. Huebert, Kolf O. Jayaweera, Carl W. Kreitzberg, Richard Gary Layton, Yeong-Jer Lin, Byard W. Mosher, David G. Murcray, Jerome Namias, Gregory D. Nastrom. Takeshi Ohtake, Joyce E. Penner, Roger A. Pielke, Ruth A. Reck. Gary J. Rollman, Philip B. Russell, David C. Sands, Vinod K. Saxena, Russell C. Schnell, and Anne M. Thompson.

There were 73 applications for funds to attend the IAGA meeting, of which only 21 could be funded. The average grant was \$800. Grant recipients are Sushii K. Atreya, Subir K. Banerjee, Jeffrey M. Forbes, Michael D. Fuller, Suman Ganguly, John T. Gosling, John F. Hermance, David D. Jackson, Margaret G. Kivelson, Shallendra Kumar, Steven P. Lund, Christopher P. McKay, Christopher T. Russell, Michael Schulz, Thomas J. Shankland, Antony C. Fraser-Smith, Rob Van der Voo, Craig A. Tepley, Raymond J. Walker, Richard L. Walterscheld, and Richard A. Wolf.

# Meetings

# International Radio Science Meeting

The 1982 International Symposium sponsored by the IEEE Antennas and Propagation Society (IEEE AP-S), the National Radio Science Meeting sponsored by USNC/URS Commissions, and the Nuclear Electromagnetic Pulse Meeting (NEM) will be held jointly at the University of New Mexico in Albuquerque, May 24-28.

A joint call for papers has been issued. Abstracts, due January 4, should be sent to Kendall F. Casey, The Dikewood Corp., 1613 University Boulevard, N.E., Albuquerque, NM 87102. Requests for general meeting information should also be directed to him. Inquiries on the technical program should be directed to the respective technical program committee chairman: IEEE AP-S: K.F. Casey and B. K. Singaraju; USNC/URSI; K. F. Casey; and NEM: K. C. Chen and L. D. Scott.

Information on accommodations and travel should be requested from Denise Griego, Albuquerque Convention and Visitors Bureau, 401 Second Street, N.W., Albuquerque, N.Mex. 87102 (telephone: 505/243-3969). 48

# Coal's Effect on Water Quality

A call for papers has been issued for the international Conference on Coal-Fired Power Plants and the Aquatic Environment. The conference is scheduled for August 16-18, 1982, in Copenhagen, Denmark.

The meeting will address three sources of water pollution (thermal, solid waste, and airborne particles) and the confsponding prevention measures.

The conference is sponsored by the internation ation on Water Pollution Research, the International Union of Pure and Applied Chemistry, and the Nordio Cooperative Organization for Applied Research.

December 31 is the deadline for abstracts. For additional Information, write to Dis Congress Service, Linde Alle 48. DK-2720 Copenhagen, Denmark. 88

# Ocean Sciences: AGU/ASLO Joint Meeting

February 16-19, 1982 San Antonio, Texas Convenor: W. D. Nowlin, r., (AGU) and R. W. Epply (ASLO) Call for papers published

in Eos, June 23.



# 1981 Spring Meeting Report

Approximately 2150 participants registered for the 1981 Spring Meeting. More than 1500 papers were presented The spaciousness of the Baltimore Convention Center provided ample opportunity for attendees to exchange ideas and interact with their colleagues. Here are some candid shots.

Changes to the program and late and revised abstracts are printed below.





G36. K. S. Wallace et al. GP58, T. M. Hoar and C. K. Seyfert H73, D. P. Dethier; H75, S. W. Wheatcraft and R. W. Buddemeir; H79, L. E. Dunlap and J. M. Spinazola. M2, R. M. Endlich et al.; M9, P. G. Black et al. 016, C. T. Carlson et al.; 018, W. McLeish et al.; 076, R.



Chambers and N. Hawley; 0103, R. J. Spencer et al.; 0132, F. R. Siegel and S. Bloch; 0133, T. J. Barrell; 0134, T. J. Barrett et al.; 0152, D. G. Aubrey and P. E. Speer. P45, S. Kumar and H. A. Taylor, Jr.; P54, T. E. Cravens

S9, R. G. Daniel; S10, M. Caputo; S31, S. R. Taylor; S33, M. E. Monfort; S61, C. A. Langston; S87, C. A. To-

## SA62, S. Ganguly. SM39, D. R. McDiarmid; SM58, P. F. Fougere; SM60. R. D. Sears; SM67, C. W. Dubs; SM93, H. H. Sauer et al.; SM142, H. A. Garcia; SM174, W. Calvert. T39, M. C. Malin; T40, M. P. Ananda et al.; T78, O. L.

Anderson and Y. Sumino; T101, S. N. Cohn; T141, G.

Mavko; T188, L. D. McGinnis et al. V2, A. Meijer; V55, B. C. Chakoumakos and G. V. Gibbs V77, J. Hamet et al., V144, T. A. Hudson and R. D. Dallmeyer; V152, A. A. Eggers; V191, A. Baldasari; V208, E. S.

Patera et al.; V209, J. R. Smyth and F. A. Caporuscio:

# Late Abstracts

Papers Not Presented

CA LINVITED PAPER

l bras :
Larser (ali at: Lamont-Doharty Geological
Chervatory of Columbia University, Pailsades,
Rev Fork 10954 and Department of Geological
Hances of Columbia University, New York,
Rev York 100771

The advant of althesters on orbitting stellines, beginning with STYLAS in 1973 and 3012. In 1973, has embled the gravity ited over the oceans to be determined with first praction. Reday althester measure its distance between the sarellite and the lutrananeous sen-surface which, in oceanic regions corresponds closely to the gaotd. This good includes disturbance due to ocean-craphe effects such as tides, scorp surges and remains but these are generally small instead of includes disturbance due to desiry differences in the Earth (a few to density differences in the Earth (a few to density differences in the Earth (a few attest to a few handred metrer). The direct subspreasant impact in both gardeny and georispics. Althester data is being used to recover its I' seen gravity monaties in the crass and to improve gravity field models. Formires good anomalies of supplitudes up to its 9 saters and wavelength AT 50 to 1500 km have been observed over sammounts, samisaic ridges and oceanic plateaus, fracture somes and continuation of the nature of inostesy in its oceans, particularly the depth of the compessation. In addition, longer wavelength told anomalies (AT 3000 to 4000 km) are provided information on geological processes not related to inostesy and the mechanical properties of oceanic lithosphere. These include the harmal actuature of commit lithosphere and the depth and plan form of convection in the Lith's mentle.

heid A. Hestings (Technicolor Graphic Services, Ros Data Center, Bioux Falle, AD 57198) Spenger R. A. Langel)

Speasor R. A. Langal)

The Preliminary soalar anomaly map compiled from asgnetic field satellite (MASSAT) data cloudy resembles the map derived from POGO (Polar Chity casebles the map derived from POGO (Polar Chity C

HB INVITED PAPER MODELS AND WATER RESOURCES DECISION-MAKING

Robert N. Friedman (Office of Technology Assessment, U.S. Congress, Vashington, D.C. 20510)

resource problems. Preliminary fludings include:

1. Models are post often used to assist operational management and small-scale plemaing. They have less successfully been integrated into comprehensive river basin planning and policy taking.

2. Although water resource model use is excessive at the federal level, coordinated modeling efforce have been rars.

3. White most scattes currently use models, many states would like to broaden their modeling capabilities. However, due to limited resources and poor information about model avaitability, most states are unable to improve their capabilities.

4. There is a wide variation in the quality and utility of water resource models. Revever, information about the quality or appropriate use of these tools is difficult to obtain, and in many imprances unknown due to a lack of model evaluation.

5. In the past, model development activities

model evaluation.

5. In the past, model devalopment activities have recedyed primary emphasis, without adequate attention to technology transfer and user support. Attention to institutions eupport, as well as a problem solving approach, has been lacking.

HC INVITED PAPER PEDERAL RESEARCH SUPPORT FOR HODELS

The use of unter resources undels is pervisive throughout the Federal Agencies concerned. Agencies with a specific action mission, both use and develop water resources models through in-house or extra-surel activities. Other agencies whose wission agency is a specific action of the contract of the con and Technology through research, produce model for other researchers and for professionsis at

Many Important models have been produced by federal agancies. Some are special purpose, s.g. in the U.S. Arey Corp of Engineers and ETA. Others are general purpose and/or experimental.

Research has been largely responsible for the increase in relevance and currency of present models available and is proceeding to extend the tange and power of presently available models.

HD INVITED PAPER THE EFFICACY OF NATER RESOURCES HOBELS: MODEL DEVELOPERS PERSPECTIVES

Jared Cohon (Department of Geography and Environmental Engineering, Johns Hopkins University, Baltimore, Maryland 21216) HE INVITED PAPER

SESSION OVERVIEW Y. V. Haines, Director, Center for Large Scale
Systems and Policy Analysis, Case Mestern
Reserve University, Cleveland, Okto 44106

The purpose of this session is to evaluate the efficacy of modeling in water resources focusing on the following aspects and issues (1) How responsive are these models to the needs of solving their Resources are bless today?

(2) How credible are these models?

(3) How usemble are these models for planning, operational; and policy decisions by local, state and federal agencies?

(4) How credible is the data base?
(5) Are there coordination problems among model developers and users, and how can they be rasolved?
(6) Are there codel raintenance problems, and how can they be solved?
(7) What technology transfer problems exist, and how should they be addressed?
(8) What training and adducational problems exist, and what should be our response?

The scheduling of this session coincides with the planned release of a study report on the subject conductes by the Congressional Office of Technology Assessment.

WATER BALANCE AND FLOSHING TIME AS PACTORS II HID-WEST LAKE ACIDIFICATION

Orie Loucks (The Institute of Ecology, Indianapolis, 18. 46208)

ENGIFIACE ACCUMINATION OF STRONG ACIDS AND RELEASE DURING SPRING MELT Dean S. Jeffrias |Lianology and Toxicity Section, Ontario Ministry of the Environment, Sox 213, Remials, Ontario,

r. B.H. Friedman)

Bulk deposition and smoothed accumulation of N', Ca', NN1, So, ', MO1, and Cl' has been passured at several locations in south-central Ontario. Farameter concentrations in interpreted smoothed samples change over the course of the vinter and are commonly lower (particularly So, ') than the corresponding bulk deposition. Assessment of the smoothed police suppents that the reduced concentrations occur through loss of ions by downerd aigration. During periods of smoothed; stream concentrations sublibit differing relationships with discharge, depending on ion. Califors and alkalinty concentrations ere reduced up to charge, depending on ion. Calcium and alkalinity concentrations are reduced up to 10-fold during spring runoff, while go." concentrations remain constant, and is increases up to 10-fold. The imput of it associated with spring suit constitutes a significant portion of the total annual it loading supplied by

SOCIAL TRINDS AFFECTING DESCRIPTIONS

Erm Visches, Dagt. of Sociology, Colorede State University, Pt. Coline, Co.

This paper attempts to describe special treads and developments associated with dry environments in the U.S. while addressing conceptual and matchingistal childrens around the widely debated concept of "devertificative."

The west and and stones of "General Realists The west and the 100th perision is characterized by: (a) feedile scorystems and potentially streamful environmental conditions; (b) a streamful environment, resulting from repid urbanization, spreak, and industrialization which decreases the risk of "idencetification" for larger expents of "population" which are becoming quite complex as an intreasing number of interdependent bysiess are affected; (d) properties actualization that are becoming quite complex as an intreasing number of interdependent bysiess are affected; (d) properties actualization to a infire feature) resources emphasis and a shift feature actual resources emphasis and a shift feature results and people in order to hitcomodulate policies for resource scarcities, climitic vageries, and the uncartainty of future environments.

Olver the vastness of the still West, the arrowing impacts, its accounted unings, and their synengistic affacts, a bit siet uniterstantine of natural resources are, societal transformations within and catalise the restor, regional inspection, and this restor, regional inspection, and this restor, regional inspection, and this restoration and the restor, regional inspection, and this resources, as a society of the resources of t

Paula J. Stone (Office of Technology Assessment, United States (Ongress, Mashington, D.C. 20510)

H37A INVITED

DISCUSSION TOPIC: WATER AVAILABILITY FOR SYNTHETIC FUEL DEVELOPMENT, OVERVIEW Leo M. Eisel (Wright Mater Engineers, Inc., Denver, Colorado 80211) (Sponsor: P. J. Stone)

H378 INVITED

DISCUSSION TOPIC: MATER PEQUIPEMENTS FOR SUNTHERIC FUEL PLANTS Harris Gold (Water Purification Associates, Cambridge, Mass. 02142) (Sponsor: P. J. Stone)

DISCUSSION TOPIC: WATER AVAILABILITY FOR SYNTHETIC FUEL DEVELOPMENT, DATA frederick A. Kilpstrick (USGS, Reston, Yirginia 27092) (Sponsor: P. J. Stone)

H37D INVITED

DISCUSSION TOPIC: WATER AVAILABILITY FOR STATECTIC FUEL DEVELOPMENT, MATIONAL

Gereld Seferall (U.S. Water Resources Countils Washington, D.C. 2003) (Sponsor: P. J. Stone)

HATE INVETED

DISCUSSION TOPIC: WATER AVAILABILITY FOR SYNTHETIC FUEL OLVELOPMENT, PEGIONAL PERSPECTIVE

Harvey Bants (Camp Dresser Filee, Inc., Belmont, Lalifornia 94072) (Sponsor: P. J. Stone)

DISCUSSION TOPIC: MATER AVAILABILITY FOR STHINETIC FLEL DEVELOPMENT, INDUSTRIAL PERSPECTIVE

M37G INVITED OTSCUSSION TOPIC: WATER AVAILABILITY FOR SYNTHATIC FUEL OCYCLOPMENT, CASE STUDY OF THE YELLOWSTONE PLYCH BASIN

Constance II, Boris (University of Michigan, Ann Irbor, Michigan 4810e) (Spontor: P. J. State)

HISPA REVITED

THE MEED FOR DAYA TO RELATE DELECTED.
WATER AND REALIN

Miley D. Bousewright, American Society for Microbiology, 1913 I Street, M.W., Mashington, D.G. 20006. Formerly, Metional Academy of Sciences, Machington, D.C.

A sories of three books on Drinking Water and Health have been published by the Martional Acadesy of Sciences in the past four years and a fourth voluce is in proparation. The literature scatches re-quired for the preparation of these volutes have broadly in a second content.

SEASAT SAN PESPONSE FROM WATER RESOURCES

State J. Stanchard
A. T. C. Chang (both at: Earth Survey
Applications Division, MASA/Goddard
Space Flight Center, Greenbelt, MJ. 207/1)

An initial investigation of the Seast yetheric sporture raise (SAR) data was synthetic apertura radar (SAR) data was directed toward estimation of soil solutors; suggesting type, aufface reagans as at to tillage and Flo. directed under forest campy. The SAR response was validated with a series of date sain From an L-band scatterwester flows in the MASA C-100 alteraft. Soil switches in the sourface 15 cm from fields of mile, aidatis, and have not produces sluster dillarances (9 db range) in the scattering collisient from both system. Must agricultural suggestation vas offertively transparent and was practicated by this straightful to the content of the supplied of the sillage roughness could be detected through the corn campy. Forest campy in cultrast produces an Series esturns except when the forest floor is flooded forest produced A to 6 db higher exattering coefficients than no officeded. There was hoth the SAR and mattercreater. There was no directable difference in temporal from intler and der fillige forest cancer. Cityu har tillege patterns were used to illustrate the look angle dependence of rew direction offsets on the caffer teturn. Poughness due to tillings can produce as much as 12 db increase to ruturn. The feasit SAB produced valuable information and in sema instances would enable unitables of parameters that are not toxistic with any other brown

STATES DESIGN SMENT DE STATAT SYNTHETIC APPRENA

R. T. Bull and D. A. Bothisch (Folar 5-lea & Center, twiserates of Mushington, 1957 Foundalt Lea Mr. Scattle, MA 19105)

Ingres intested by a synthetic agestore tader on STA-TAT have been used to rectain men ice displacements over a three destaurant. In Carbon 1976. The data colors the roughly along a line and ate quite desta-ation i has agest-over a distance of 851 bm. The lisplacements are at at them, bilimeters. Displace-ment efforts grow with distance form shore becoming as large as 3 bm. The graph of displacement versus distance has an assignal discontinuities of several bil. meets. Unplacement discontinuities are accurate to \$ 0.07 hm along track and 3% of their magnitude

P298

TURK FOLAR VANSERING

fular war faring, or retrientation with tearcet to the mais of totation, occurs if mass is reductabled on a placestary body and if its interior flows by totid state creep order small stress differences. This process might be expected to have occurred during the early history of the Mich and Mars. Evidence for its occurrence on the Mich and Mars. Evidence for its occurrence on the Mich and Mars. Evidence for its occurrence on the Mich and Mars. It is deducted by the application of the magnetic amounties detected by the apollo the magnetic amounties detected by the apollo the civilia force in the parturated fluid lumar care fields to the assumption of an axial dipole field. Strong arguments salts for inserpreting the directions of magnetization of the crust as the ancient lumar field directions. cruit as the Encient liner field directions. The pole positions corresponding to them fall into anticolal groupings along three different area, irrespected as representing three different ages. Folar wandering is interpreted as taking caused by the last great impacts and their ister flooding with laws to produce the

THE PIS VELOCITY PRECURSOR: A DESIVATION FROM A STICKUSTIC MODEL OF PRACTICALISM

R. Soutest (Venezuelen Formistion for Setundin giral legeaten - Apartado 1692, Caracas 1010.

ity fastic Persurtation Theory to explice to the preguation of classic tody wases to a randomly stratified section. For the P and SV nodes there of a siter perturbation of the obligant wash. She at a said; attaitable at the total of the control by Substitution of the density and the fractions. It has been of the density and the shear modulu the herestoral integral mode of in taken to be larger than the werestal mode of he a factor follows the taken to be a factor for the " " I maked see "stratification indea. This art, to particular, the ratio revolve,

and the learnest to surescal fractures proliferate to the outer control ingion the length file in - 3 - 25 felelding. Early 17. This charges several pasteries in the website rail or which despine the fallering peakedwars fall from a recovery to are county values or fineressan. The number finer is expected, in a tou-dimensional model, as the fire this editional to the fire this edition of the country peaked in a time despite out the same and the representation of the place of the pl

SIDIA

SOME CONCEPTS ON THE PERATECHERIES OF TRAVEL THE ANCHALIES, MAGNIFICE EXSTENSES AND OTHER CHOPSTHICAL PARAMETERS

Michael J. Shore (Department of Earth and Planetary Molecoms, Johns Mophina Omireroity, Majlinger MD 2]278)

Many authors have emposted that verifyide permittions wrist between various parameters. These expellations are normally attributed to the physical properties of the 10v velocity none and opported parts of the mantie. To support of body wive attemption studies, assemblers would like to develop indirect measures which could reliably predict the

relative differences in attendation at widely spaced stations.

Heamy counts of travel time residuals.

Heamy counts of the last flow sequences were obtained from the 1976 NOA Worldside Data

Heamy could weak were extracted from a Base and goold values were extracted from 1979 MAGA estellite goold. Evaluation of

1979 NASA satellite quoid. Evaluation of the data indicates a linar correlation coefficient (r) of 0.7 for body wave asymptota residuals and Pn velocity. Less significant correlations (r = 0.5 to 0.6) are noted between magnitude residuals. Pn velocity and the geold with travel time residuals, and between heat flow and Pn velocity (r = 0.4). Beat flow is poorly correlated with asymptode residuals. Even though the strongest correlation was observed between magnitude residuals could only be predicted with 75% confidence for a given Pn velocity to 40.24 seguitude units. Therefore, the use of sitemetive geophysical parsecare, the use of sitemetive geophysical parsecare, the use of alternative geophysical parametr to predict magnitude residuals at a partic ular station does not appear eccurate enou-to significantly improve individual station

SA76A

OPTICAL AND RADAR COLLABORATIVE RESEARCH IN

J. V. Mariumther. Jr.

- s, nays L. F. Hagy (all at: Space Physics Sesserch Laboratory, University of Nichigan, Ann Arbor, Michigan 45109) Collaborative research between optical instru

mentation and the incoherent scatter redai pro-wide valuable complementary data shout the state of the atemphere. Optical wants such as inter-ference or a spectrophotometers, and interference filter photometers may be used to measure them spheric neutral winds, neutral temperatures, and sirgiou or autral surface brightnesses as a function of time or direction. The radar provides dara as a function of height for innospheric variables such as electron describes, (on each electron central temperatures, and ion drifts also as a function of time or direction. The two sets of information provide a unique foundation for aerocomical studies of autoral chemistry and dynasics. Topical areas featuring such collaborative tessench in Alaska for the last ten years will be reviewed, and our plans for an optical facility at Sondre Stromfjord proposed to the Mational Science Foundation will be discussed.

STRULTANEOUS MEASUREMENTS OF YET THANKHISSIORS IN THE MESOSPHENE AND STRATOSPHENE

C.A. Cornish, R.F. Pfaff, S. Powell, F. Kintoer, M.C. Relley (School of Electrical Engineering, Cornell University, Times, NY 1455) R. Molkowith (The Arropace Corporation, P.O. Box 92357, Los Angeles, CA 90009)

Q2557, Los Angeles, CA 90009)

Continuous VIF signals from earth-based transmitters were received between 60 hm and 90.2 km by a Nike-Orion sounding rocket and at 30 km by a high altitude belicon. The rocket was launched at 02:80 UT on August 14, 1981 at Vallops Imland, Virginia, and performed three orlongonal wave measurements using symmetric double probe electric field sensors apaced 5,5 metra apart. It three channels received broatband signals, for which telemetry considerations limited their maximum frequency responses to 20.0 MHz, 18.6 MHs, and 80.5 MHz. Many discrete transmissions were received of which the OMEGA and WA transmitters have so far been identified. The balloon, with double probes spaced 3 meters spart, was also launched at Vallops Island, and received continuous data from 2115 to 3115 UT at 30 km sittude in a filter channel metered at 17.8 MHz. The received signal, which we believe originated at the Balloon spin period of 21 seconds mad provides a "baneline" power becautement. At this same frequency, the rocket measurement. At this same frequency, the rocket measurement. At this same frequency, the rocket measurement. At this same frequency, the rocket measurement as alrong continuous signal whose power level aboved a marked decreams (5-7 dB) in the region between 70 and 80 km on both the upleg and region between 70 and 80 km on both the upleg and downing. We investigate these received powerlevels in light of the electrical characteristic

PARABOLIC DISSOLUTION RINETICS - AN ARTIFACT OF PRECIPITATION?

G. M. Holdren, Jr. and J. E. Adams (Dept. of Geological Sciences, University of Rochester, Rochester, N. Y. 14627)

The rate limiting step for the dissolution of feldspar and other primary silicate minerals is thought to be a surface controlled reaction process. According to this model, the rates of dissolution for these minerals should be constant through time in dilute aqueous solution under conditions of constant solution pt, almeral surface area and stirring rate. This prediction is in conflict with a large body of experimental evidence which suggests that the dissolution kinetics of these minerals follow a parabolic rate law.

Outs have been coils ted which suggest that this discrapancy may r suit, in part, from the monequilibratum precipi ation of amprihous aluminosilicates which occurs during the course of dissolution experients. Experiments have performed to observe it is kinetics of formation of amorphous precipitals under conditions which are similar to these employed in mineral dissolution studies. Concentrated (0.05%) Aland 51- containing solutions were slowly and continuously added to 1.5 to 2.0 liters of buffered aqueous solution (ph - 5.1). The The rate limiting step for the dissolution of

continuously added to 1.5 to 2.0 liters of buffered aqueous solution (pi - 6.1). The addition rates were such that total Al and Si concentrations increased linearly with time. Results indicate that the vates of formation of the ascrphous alwinosilicate pracipitates increase during the course of an esperiment, producing ipparent addition rates for silicon. These results strongly suggest that the non-linear dissolution functics observed in previous mineral dissolution studies may, to an extent, be artifacts of secondary pracipitation reactions which occur in those systems. Also, the results suggest that the actual dissolution processes need not be affected by and are taking place independently from the precipitation reactions.

An Overview of Mattenus Science foundation Program in Autronomical Atmospheric, Earth and Ocean Sciences

1459 M. Grant Grees (Division of Ocean Scientes)
15|6 Zdrard P. Todd (Division of Polar

Program: | 1550 Peter S. Willales (Division of Ocean Drilling Programs)
1550 F. Robin Brett, (Division of Earth

ISF, through the Directurate for Astronomical, Atmaphoric, Parth and Deuma Belmecs (AABO), is a major source of support for research in the earth related beloeses and sitement. The AABO Directurate supports the patients sixtensonic The AABO Directurate supports the patients sixtensonical observatories, the Satients Conter for Atmappedic Research, the secdedic Fiest, the U.S. AARATCHIE Program and the occass drilling programs. Depressively-es of the AABO Division of Atmappedic Betages, Teamographic Sciences and Earth Sciences, the Division of Found Programs and the Division of Pound Programs and the Division of Pound Printing Traignant will discuss the status of current programs and possible biture developments.

**Revised and Additional** Abstracts

ORDER-DISORDER KINETICS IN FERROMAGNESIAN SILICATES, AND THE COOLING HISTORY OF ROCKS. Jibanitra Ganguly (Dept. of Geosciences, University of Arizona, Tucson, AZ 85721)

in many ferromagnesian silicates; Fe<sup>2+</sup> and Mg are disordered over two or more nonequivalent crystallographic sites. The temperature [q, at which the observed ordering state of a natural crystal has been quenched, depends on the rate of cooling of the host rock [q < the temperature of anatoms equilibrium of the stepperature of anatoms equilibrium of the second or natural crystal has been quenched, depends un the rate of cooling of the host rock [1q < the teoperature of apparent equilibrium of the quenched ordering state]. Solution for 7q has been obtained for the mon-linear cooling model, 1/1-1/1 + c(time), from Mueller's (1969) timetic treatbent of intracrystalline exchange. Muserical method and program have been devel-oped to calculate the change of site occupancy, A, as a function of T (which is at function of the in cooling system) for any rock cooling model. The cooling rate constant can be varied until the calculated X vs. T relation repro-duces the observed quenched state. The model has been applied to a number natural pyroxene and (a-poor amphiboles. The kinatic data for orthopyroxene by Yingo and Hafner (1969) and Beasancon (1980, AGU Spring Meating) have been applied to the data for intracrystalline dis-tribution of fe and Mg for a clinopyroxene sacple from kimberlite (McCallister, et. al., 1976, Amer. Hinnerl., 61; sample JPHN 1600E4). It is assumed that the energetic properties of fe- and Mg-centered octahedra are similar in the two silicates, and the effect of Ca is limited to simply blocking a certain mumber of 2 sitos from participating in the intracrys-tallino exchange of fe and Mg. The two sets of kinetic data yield approximately 6 days and one year, respectively, for the cooling of the sample to Iq, which is ~ 520° C. From palac-naggetic study, McFadden (1973) suggested 550-60° C for the intrusion temperature of the host kimberlite.

G44 RLVISED

ALTERNATIVE FILTERING TECHNIQUES APPLIED TO THE EARTH'S GRAVITY FIELD Christopher Jekelf (Department of Geodetic Science, The Ohio State University, Columbus, Ohio 43210)

Well known filters in Fourier spectral analysis, such as the roctangular. Caussian, and Hanning filters, are adapted for data on a sphere. The different emocthing proparties can best be stedded by examining the corresponding frequency response functions (i.e. the spectra of the filters). The low-pass filter most often esed on gravity data is the rectangular (or Fellinen) filter. However, its spectrum has relatively large sidelohes; and therefore, this filter passes a considerable part of the apper end of the gravity spectrum. The spherical adaptations of the Gaussian and Haming filters are more efficient in suppressing the high-frequency components of the gravity field since their frequency supposes functions are strongly tapered at the high frequencies with no, or small, sidelohes.

# Seismology

THE EFFECT OF PUPLORE COMPLEXITY ON CSTIMATES OF STREET RELEASE

John Boatwright, U.S. Geological Survey, Menlo Park, CA 94025

(sponsored by F. Archuleta)

Ine shear waves radiated by eight multiply recorded aftershocis (3.6 M<sub>L</sub> 4.9) of the 1975 frowille, California, earthquale have been analysed for a variety of time-domain and spectral measurements. The relative complexity of the testimate the velocity waveforms is quantified to estimate the terrupture complexity and thereby bound the average rupture vehocity. The measurements of corner frequency, characteristic frequency, repture phase duration, and pulse duration are inverted for estimates of the source size. The inversions of the duration measurements if it he variation with takeoff angle to estimate the rupture geometry. The comperision of source size estimates indicates that for complex earthquakes ine corner frequency is more sensitive to the sub-event size than the overall event size.

Five different estimates of others release are considered over the data set. The apparent stress, the dynamic stress drop and a stress drop estimated from the rms acceleration of the shear wave arrivals give robust estimates (85-250 bars) which correlate remarkably will across the eight events. The static stress drop determined using the rupture areas calculated from the pulse durations correlates adequately with the three dynamic stress drop estimates, while Brune's estimates of static stress drop correlates poorly with the other estimates. In general, the estimates of static stress drop are less reliable than the astimates, of dynamic stress drop.

# SPR: Magnetospheric Physics

SATURNIAN KILONSTRIC RADIATION OBSERVED BY VOTAGES-1 MEAS TITAN

H. D. Desch (both at HASA/Goddard Space Flight Center, Laboratory for Estraterre, Physics, Pimetery Magnetospheroa B Greenbelt, Maryland 20771)

The radio solution observed at 56 kHz when the voyager-1 spaceraft flus past Titos has been proposed as secanting from Titan itself. We have a sawined the observations made by the Voyager-1 and 2 Planetary Radio Astronomy instruments during this period. Both appeaceraft detected atrong estasion over the bend from about 40 kHz to 200 kHz. Sheet Voyager-2 was then some 1.8 AU from Satura, we were able to compare the seasured signal strengths with those expected from a Titan radio source. Assuming both appareraft could equally wall view the source, we would expect the signal to be some 95 MS teaker as observed by Voyager-2 compared with Yoyager-1. In fact, the measured signal difference is about 7 dB witch is almost amonity that expected if the source were at Satura rather than Titan. Therefore, we conclude that the emission detected by Yoyager-1 near Titan closest approach is simply Saturaian Kilómetric Radistion, and not a new radio pource.

MACHITOPAUSE HORELING, USING ISSE-1 EMERGETIC PARTICLE DISTRIBUTIONS

7. N. Springr (NOAA Space Environment Laboratory Boulder, CO 80303)
D. J. Williams (Also at Dept. of Astro-Geophysics, University of Colorado, Boulder; CO 80309)

Savaral magnetopausa excessings at a chearyed on the indouent pass of ISER-1 on Sovember 10, 1976. The observed three-dimensional sehepsite ion distribution functions (74-120 keV) are studied in the magnetosphere, the magnetopausa and segmental sheath. Selected magnetophere, and sheath measurements are used to intribulis; particle

orbits in a simple one-dimensional quasi-static model. Proton orbits are followed from the magnetosphere into the sheath and a modeled sheath distribution is constructed, using Licoville's theorem, which is then compered to the observed distributions. The model is consistent with the observations for an inward-pointing mornal magnetic field component and for tangential electric fields less than about 1/2 mV/m. This podel assum to work both for "fivz transfer events" and neighboring "quasi-trapped" thank distributions, implying that the region of open field lines in the sheath may be broader, not quite as lotal, as proviously thought. Protons of different engines and pitch angles sample different regions of the magnetospause. This result, coupled with some of the observations, lends qualitative support to the conjecture that tangential electric fields above our uppar limit may exist over localized regions of the magnetospause.

# Geophysical Year

(Boldface indicates meetings sponsored or cosponsored by AGU.)

1981

July 21–23 Chapman Conference on Spatial Variability in Hydrologic Modeling, Fort Collins, Colo. (Meetings, AGU, 2000 Florida Ave., N.W., Washing ton, DC 20009.)

July 21-30 21st General Assembly of IA-SPEI, London, Ontario, Canada. (A. E. Beck, Department of Geophysics, Univ. of Western Ontario, London, Ontario N6A 5B7 Canada.)

July 27-30 Eighth International Symposium on Urban Hydrology, Hydraulics, and Sediment Control, Lexington, Ky. (Don J. Wood, Departme of Civil Engineering, 206B Anderson Hall, Univ. of Kentucky, Lexington, KY 40506.)

bly, Edinburgh, United Kingdom. (B. R. Lealon, Institute of Geological Sciences Edinburgh EH9 3LA United Kingdom.) Aug. 4-7 International Conference on Engl

Aug. 3-15 IAGA Fourth Scientific Assem-

gy Education, Providence, R.I. (Donald Kirwan, Conference Chairman, Office of Energy Education, Univ. of Rhode Island.

Kingston, RI 02881.)

Aug. 9-15 Symposium on Variations in the Global Water Budget, Oxford, United Kingdom. Sponsors, ICCL, IAHS, INQUA. (Prof. R. E. Newell, Department of Meteo rology, 54-1520, MIT, Cambridge, MA

Aug. 9-18 International Congress of Survevors, F.I.G., Montreux, Switzerland. Sponsor, Fédération Internationale Des Geometres. (American Congress on Surveying and Mapping, 210 Little Falls Street, Falls Church, VA 22046.)

Aug. 10-14 International Conference on Basement Tectonics, Oslo, Norway. Sponsor, Norwegian Petroleum Society. (Roy H Gabrielsen, Department of Geology, Univ. of Oslo, P.O. Box 1047, Blindern, Oslo 3 Norway; or Don L. Baars, Department of Geology, Fort Lewis College, Durango, CO 813013

Aug. 10-14 Water Forum '81: Technical State of the Art Exchange, San Francisco, Callf. Sponsors, American Society of Civil Engineers, Irrigation and Drainage Division, Committee on Drainage. (P. M. Meyers, 509 North Roosevelt Blvd., Apt. D-

105, Falls Church, VA 22044.) Aug. 10-19 20th General Assembly of the International Union of Radio Science, Washington, D.C. (R. Y. Dow, National Academy of Sciences, 2101 Constitution

Ave., Washington, DC 20418.) Aug. 17-28 Third Scientific Assembly of IA-MAP with Extraordinary General Assembly, Hamburg, Federal Republic of Germany. (S. Ruttenburg, NCAR, P.O. Box 3000, pulder, CO 80307.)

Aug. 17–18 Open Symposium on Mathematical Models of Radio Propagation, Washington, D.C. Sponsor, URSI. (J. R. Well, Phys. Rev. 1881). Walt, Bidg. 20, Electrical Engineering Department, Univ. of Arizona, Tucson, AZ 85721.)

Aug. 17-22 Ninth International Sym posium on Earth Tides, New York N.Y. Sponsors, IAG, IUGG, Columbia Univ. (J. T. Kuo, 828 S.W. Mudd, Columbla Univ., New York, NY 10027.)

Aug. 18-21 Second Blennial Conference and Exhibition of the Australian Society of Exploration Geophysicists, Adelaide, South Australia. (J. Haigh, Conference Chairmen, P.O. Box 42, Unley, South Australia 5061.)

Aug. 20-21 Second International Symposlum on Computer-Alded Seismic Analysis and Discrimination, North Dartmouth, Mass. Sponsors, Electrical Engineering Department, Southeastern Massachus University, IEEE Computer Society, IEEE Acoustics, Speech and Signal Processing Society. (C. H. Chen, Electrical Engineer ing Department, Southeastern Massach setts University, North Dartmouth, MA 02747.)

Aug. 24-26 International Symposium on Management of Geodetic Data, Copenhagen, Denmark. Sponsors, IAG, the Danish National Committee of IUGG, Geodaetisk Institut. (C. C. Tscherning, International Symposium Management of Geodetic Data, Geodaetisk Institut; Gamiehave Ale-22; Charlottenlund DK-2920 Denmath) Alig 24-29 Eignith Annual Meeting of the Oct. 14-16 Third Surveying and Mapping Colloquium for the Petroleum Industry, Banff, Alberta, Canada. Sponsor, Canadian Petroleum Association. (Liz Hampton. Canadian Petroleum Association, 1500, 633 Sixth Ave., S.W., Calgary, Alberta,

European Geophysical Society, Uppsale

ganizing Committee, Institute of Solid

558, 22 Uppsala, Sweden.)

Church, VA 22046.)

Sweden. (C.-E. Lund, Chairman Local Or-

h Physics, Uppsala University, Box

Aug. 25-27 The Royal Institution of Char-

tered Surveyors Centenary Celebration,

London, England. (Representative Rad-

Inski, American Congress on Surveying

Aug. 28-Sept. 9 Arc Volcanism Sympo-

slum, Tokyo, Japan. Sponsors, Volcano-

logical Society of Japan, IAVCEI. (Dalsuke

Shimozuru, IAVECEI Symposium on Arc

Volcanism, Earthquake Research Institute.

Univ. of Tokyo, Bunkyo-ku, Tokyo 113 Ja-

Aug. 31-Sept 2 Third International Collo-

gulum on Mars, Pasadena, Calif. Spon-

sors, NASA, Lunar and Planetary Institute,

Division of Planetary Sciences of the AAS

(Conway W. Snyder, Jet Propulsion Labo-

Aug. 31-Sept. 5 Symposium on Geodetic

West Germany. Sponsor, IAG. (Deutsche

Akedemie der Wissenschaften, Marstalt-

Sepi. United Nations Symposium on Water

Management in Industrialized Areas, Lis-

bon, Portugal. (Chairman of the Executive

Water Management in Industrial Areas,

Sept. 7-12 Third International Symposium

Sonsors, International Commission on

Snow and ice. International Glaciological

Society. (Institute of Polar Studies, Ohio

State Univ., 125 S. Oval Mall, Columbus,

grammetry-American Congress on Survey-

345 Middlefield Road, Mail Stop 31, Menlo

Sept. 8-12 American Society of Photo-

ing and Mapping Fall Convention, San

Francisco, Calif. (L. W. Aggers, USGS,

Sept. 13-17 National Water Well Associa-

water Technology Education Session,

lion 33rd Annual Convention and Ground-

Kansas City, Mo. (NWWA, 500 West Wil-

son Bridge Rd., Worthington, OH 43085.)

Sept. 16-18 Oceans '81, Boston, Mass.

AGU. (R. Nagle, Publicity Manager, Ray-

theon Company, 141 Spring St., Lexing-

Sept 17-18 Midwest Meeting, Minne-

apolis, Minn. (Meetings, AGU, 2000 Flori-

da Ave., N.W., Washington, DC 20009.)

Sept. 17-18 Pacific Northwest Re-

gional Meeting, Ellensburg, Wash.

of Geology, Ellensburg, WA 98920.)

(Bob Bentley, PNAGU, Central Washing-

ept 20-22 National Water Well Associa

ion 34th Annual Convention and Exposi-

tion, Atlanta, Ga. (NWWA, 500 West Wil-

son Bridge Rd., Worthington, OH 43085.)

Sept. 28-Oct. 10 NATO Advanced Study

institute on Chemistry of the Unpolluted

and Polluted Troposphere, Corfu, Greece (W. Jaeschke, Center of Environmental

relection, University of Frankfurt, Robert-

Mayer-Str. 11, 8000 Frankfurt/Main, FRG.)

0d. 6-8 International Conference on Time

Series Methods in Hydrosciences, Burling-

ton, Ontario. Sponsors, National Water Re-

search inatitute of the Canada Centre for

Inland Waters and Water-Resources

Branch of Ontario's Ministry of Environ-

ment. (A. El-Shaarawi, Aquatic Physics

and Systems Division, NWRI, Canada

Centre for Inland Waters, P.O. Box 5050,

ington, Ontario L7R 4A6 Canada.)

Oct 7-9 John Muir Geophysical Society's

Fourth Nonannual Meeting, Lake Arrow-

0d 11-14 Coastal Society's Seventh An-

West, Coastal Society Conference, De-

Oct 11-15 51st Annual International Meet-

ng of the Society of Exploration Geophysi-

dis, Los Angeles, Calif. (William L. Baker,

Technical Program Chairman, c/o Chevron

Ol Field Research Co., Box 446, La Ha-ba, CA 90631.)

Oct 12-18 Third International Ocean Dis-

Posal Symposium, Woods Hole, Mass.

Sponsor, Office of Marine Pollution As-

sessment, NOAA, (I. W. Duedall, Marine

Sciences Research Center, State Universi-

y of New York, Stony Brook, NY 11794.)

Energy Conference, Baton Rouge, La.

Sponsors, Louisiana Geological Survey,

Department of Natural Resources; Energy

Programs Office, Louislana State University

y, U.S. Department of Energy. (Ann Bach-

man, Conference Coordinator, Energy Pro-

State Univ. Beton Rouge, LA 70803.)
Ot. 13-16 Division of Planetary Sciences
of the American Control of Planetary Sciences

of the American Astronomical Society An-itial Meeting, Pitteburgh, Pa. (B. Hapke, Depl. of Geology and Planetary Science, 321 Old Englandary Science,

321 Old Engineering Hall, University of Pittsburgh, Pittsburgh, PA 15260.)

13-15 Fifth Geopressured-Geothermal

Univ. of Rhode Island, Kingston, RI

partment of Geography and Marine Affairs,

ston. 1 ex. (N

head, Calif. (M. McNutt, USGS, Menio

Park, CA 94025.)

rual Conferen

ton University, P.O. Box 1000, Department

Sponsors, Marine Technology Society,

IEEE Council of Oceanic Engineering.

Park, CA 94025.)

im. MA 02173.)

on Antarctic Glaciology, Columbus, Ohio.

Portuguese Water Resources Association

CO LNEC, Av. do Brasil, 101, 1799 Lisbon,

πittee, international Symposium on

Networks and Computations, Munich,

ratory, Pasadena, CA 91109.)

platz 8, D-8000 Munchen 22.)

and Mapping, 210 Little Falls Street, Falls

Canada T2P 2Y5.) Oct. 19-22 Earth Impact Conference, Snowbird, Utah. Sponsors, Lunar and Planetary Institute, National Academy of Sciences, (Earth Impact Conference, Lunar and Planetery Institute, 3303 NASA Road 1, Houston, TX 77058.)

Oct. 22-24 Fourth Conference on the Physics of the Jovian and Saturnian Magnetospheres, Laurel, Md. Sponsor, NASA. (S. M. Krimigis, Applied Physics Laboralory, Johns Hopkins Univ., Laurel, MD 20810.)

Oct. 26–30 Symposium on Quaternary Land-Sea Migration Bridges and Human Occupation of Submerged Coastlines, La Jolla, Calif. Sponsors, Quaternary Shorelines Commission of the International Union for Quaternary Research, Scientific Committee of the World Confederation of Underwater Activities. (Patricia M. Masters, Scripps Institution of Oceanography, A6-012, La Jolla, CA 92093.)

Oct. 29-31 28th Annual Eastern Pacific Oceanic Conference, Idlewood, Calif. (R. Michael Laure, EPOC Secretary, Southwest Fisheries Center, NMFS, La Jolla, CA 92037.)

November 1-6 Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oreg. Sponsor, Estuarine Research Federation. (Jay F. Watson, Treasurer, USFWS Suite 1962, 500 N.E. Multnomeh Street, Portland, OR 92232.)

Nov. 2-6 International Conference on the Venus Experiment, San Francisco Bay Area, Calif. Sponsor, NASA. (Dr. Lawrence Colin, Ames Research Center, Moffett Fleid, CA 94035.)

Nov. 9-11 Special Conference on the Mechanical Behavior of Salt, University Park, Pa. Sponsor, Rock Mechanics Laboratory, Department of Mineral Engineering, Penn sylvania State University. (H. Reginald Hardy, Jr., Rock Mechanics Laboratory, Room 117, Mineral Sciences Building. Pennsylvania State University, University Park, PA 16802.)

Nov. 9-20 Second Symposium on Geodesy in Africa, Nairobi, Kenya. Sponsors. IAG. IUGG Local Committee of Kenya. IUGG Committee on Advice to Developing Countries, African Association of Cartography. (R. Omandi, Survey of Kenya, P.O.

Box 30046, Nairobi, Kenya.) Nov. 30-Dec. 11 43rd Session of the International Statistical Institute, Buenos Aires, Argentina. (Jim R. Wallis, IBM, Research Division, Box 218, Yorktown Heights, NY 10598; or G. S. Watson, Bernoulli Society for Mathematical Statistics and Probability. Department of Statistics, Princeton Univ.,

Princeton, NJ 08544.) Dec. 3-5 Topical Conference on the Processes of Planetary Rifting, San Francisco, Calif. Sponsor, Lunar and Planetary Institute. (Rift Meeting, Projects Office. Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058.)

Dec. 7-11 AGU Fall Meeting, San Francisco, Calif. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.) Dec. 18-19 Annual International Meeting of

the Working Group on Mediterranean Ophiolites, Florence, Italy. (Luigi Beccaluva, Istituto di Petrografia, Via Gramsci 9, 43100 Parma, Italy.)

Jan. 11-14 Symposium on the Understanding of Hydrologic Processes at the Basin Scale, Caracas, Venezuela. Sponsors, Universidad Simon Bolívar, IAHS. (Ignacio Rodríguez-Iturbe, Universidad Simón Bolivar, Apartado Postal 80.659, Caracas 1081. Venezuela.)

Feb. 8-12 Third International Geo-Symposium on Satellite Doppier Positioning, Las Gruces, N. Mex. Sponsors, Defense Mapping Agency, National Ocean Survey, AGU. (Richard Peat, Defense Mapping Agency, Hydrographic/Topographic Center, 6500 Brooks Lane, N.W., Washington, DC 20315.)

Feb. 16-19 Ocean Sciences: AQU/ ASLO (American Society of Limnology and Oceanography) Joint Meeting, San Antonio, Tex. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

Mar. 22-26 International Symposium on Hydrothermal Reactions, Yokohama, Japan. Sponsor, Tokyo Institute of Technolo gy. (Shigeyuki Somiya, Research Labora-tory of Engineering Materials, Tokyo Institute of Technology, Nagatsute, Midori, Yokohama, 227 Japan.)

Mar. 24-27 Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Hayward, Calif. Sponsors, USGS, East Bay Council on Surveying and Mapping, Calif. Div. of Mines and Geol., Woodward-Clyde Consultants, Calif. St. Univ. at Hayward. (Sue Hirschfield, Dept. of Geological Sciences, California State Universi-

ty, Hayward, CA 94542:) Apr. 11-16: Penrose Conference on Anterctica, Shenandoah National Park, Va. Spon-sor, GSA, (lan W. D. Dalzell, Lamont-Do-

herty Geological Observatory, Columbia University, Palisades, NY 10964.) April 19-21 Cordilleran Section, Geological Society of America and Seismological Soclety of America Annual Meeting, Anahelm, Calif. (Neil Maloney, Earth Science Department, Calliornia State Univ., Fuller-

ton, CA 92634.) April 27—29 Chapman Conference on Rainfall Rates, Urbana, III. (Meetings, AGU, 2000 Florida Avenue, N.W., Wash Ington, DC 20009.1

May 3–7 14th International Liège Colloquium on Ocean Hydrodynam ica, Liège, Beiglum. Sponsors IAPSO, Unesco Marine Sciences Division, EGS, Intergovernmental Oceanographic, AGU. (Jacques C. J. Nihoul, University of Liège, Mecánique des Fluides Géophysiques-Environment, B6- Sart Tilman, B-4000 Liège, Belgium.) May 7-20 General Meeting of IAG, Tokyo,

Japan. (I. Nakagawa, Geophysical Insti-tule, Kyoto University, Sakyo-ku, Kyoto 606 Japan.)

May 10-12 Fourth International Conference on Planning and Management of Water Resources for Industrial, Agricultural, and Urban Use, Marselles, France. Sponsors, de Planification des Eaux (C.E.M.P.E.), Société des Eaux de Marsoille (S.E.M.), the Bureau de Recherches Géologiques et Minières (B.R.G.M.), Centre de Formation Internationale à la Gestion des Ressources en Eau (CEFIGRE), UNESCO, Commission des Communautés Européennes, Association des Hydrogéologues (AIH). (Secretariat de la Conference, Socielo des Eaux de Marseille, 25 rue Edouard Delangiado-13006 Marseillo France.)

May 17-22 International Solar-Terrestrial Physics Symposium, Ottawa, Ontario, Canada (Professor Llu, University of Illinols, Urbana, IL 61801.)

May 17-June 3 24th Plenary Meeting of COSPAR, Ollawa, Ontario, Canada. (T. W. McGrath, Executive Mombor, Local Organizing Committee, XXIV COSPAR. Conference Secretarial, National Research Council, Ottawa, Ontario K1A OR6, Cana-

May 23-26 Eastern Conference on Writer and Energy: Technical and Policy Issues. Pittsburgh, Pa. Sponsors, ASCE, League of Women Voters, Council of State Governments, (F. Kilpatrick, USGS National Center, Mail Stop 414, Reston, VA 22092.)

May 25-28 Symposium on the Composition of Nonurban Troposphere, Williamsburg, VA. Sponsors, AMS, NASA, AGU. (Jack Fishman Mail Stop 401-B. NASA Langley Research Center. Hampton, VA 23665.)

May 31-June 4 AQU Spring Meeting, Philadelphia, Pa. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

June 13-17 International Symposium on Hydrometeorology, Denver, Colo. Sponsor, American Water Resources Association. (A. I. Johnson, Woodward-Clyde Consullants, 2909 West 7th Ave., Denver, CO 80204.)

June 15-18 International Conference on Rainwater Cistern Systems, Honolulu, Hawaii. Sponsors, University of Hawaii's Water Resources Research Center. AGU. (Yu-Si Fok, General Conference Chairman, Waler Resources Research Center, Univ. of Hawaii, 2540 Dole Street, Honolulu, HI 96822.)

June 27-30 Western Conference on Water and Energy: Technical and Policy Issues, Fort Collins, Colo. Sponsors, ASCE, League of Women Voters, Council of State emments. (D. Matchett, Stone and Websier Engineering Corp., P.O. Box 5408, Denver, CO 80217.)

June 27-July 2 Fifth International Conference on Geochronology, Cosmochronology, and Isotope Geology, Nikko National Park, Japan. (K. Shibata, Geological Survey of Japan, Higashi 1-1-3, Yatabe, Ibaraki 305 Japan.)

July 19-30 50 Extraordinary General Assembly, Exeler. United Kingdom, (John C. Rodda, Department of the Environment, Water Data Unit, Reading Bridge House, Reading RG1 BPS United Kingdom.) Aug. 2-13 Joint Oceanographic Assembly,

Halifax, Nova Scotla, Canada, Sponsor, Scientific Committee on Oceanic Research. (Leo O'Quinn, National Steering Committee for JOA, c/o Canadian Committee on Oceanography, 240 Sparks St., Ollawa, Ontario K1A 0E8 Canada.) Aug. 2-6 Second International Symposium/

Morkshop on Solar-Terrestrial Influences on Weather and Climate, Boulder, Colo. Sponsor, Lockheed Palo Alto Research Laboratory. (Billy M. McCormac, Lockheed Palo Alto Research Laboratory, Dept. 52-13/B202, 3251 Hanover Street, Palo Alto, CA 94304.)

Aug. 15-21 Fourth international Sympoalum on Antarctic Earth Sciences, Ingle Farm, South Australia, Australia, Sponsors, Australian Academy of Science, Australian Academy of Technological Sciences, International Union of Geological Sciences, Scientific Committee on Antarctic Research, Geological Society of Austra-lia, Inc., Univ. of Adelaide. (J. B. Jago, South Australian Institute of Technology,

P.O. Box 1, Ingle Farm, South Austrelia,

Australia 5098.) Aug. 15-22 International Meeting on Generation of Major Basalt Types, Reykjavik, iceland. Sponsors, IAVCEI, IAGC. (Basali Meeting, c/o G. E. Sigvaldason, Nordic Volcanological Institute, 101 Reykjavik.

iceland.) Aug. 15-22 IAVCEI and IAGC Joint Moeting, Reykjavík, Iceland. (G. E. Sigvaldason, Nordic Volcanological Institute, Univ. of Iceland, Geosciences Building, 101

Aug. 22-28 11th International Congress on Sedimentology, Hamilton, Ontario, Canada. Sponsor, IAS. (IAS Congress 1982, Department of Geology, McMaster Univer-sity, Hamilton, Ontario L8S 4M1, Canada.) Aug. 22-28 Third Circum-Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii. Sponsor, IUGS. (AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101.)

Aug. 23-27 Second Symposium on Applied Glaciology, Hanover, N.H. Sponsor, International Glaclology Society. (Secretary General, International Glaciological Sociotv. Lensileld Road, Cambridge CB2 1ER, United Kingdom.)

Aug. 24-27 Ninth Annual Meeting of the European Geophysical Society, Leeds, United Kingdom. (J. C. Briden, Departmen of Earth Sciences, University of Leeds, Leeds LS2 9JT, England.)

Sept. 3-11 Fourth World Congress on Winter Resources, Buenes Aires, Argentina. Sponsor, International Water Resources Association, (G. E. Stout, President of the U.S. Geographical Committee, Water Resources Center, University of Illinois, 2535 Hydrosystems Laboratory, 208 N. Romine, Urbana, IL 61801.)

Sept. Third International Kimberlite Conference, Clermont-Ferrand, France. (Francoise Boudier, Université de Nantes, Laboratoire de Tectonophysique, 2 Rue de la Houssiniere, 44072 Nantes, France.) May or Sept. Scientific Meeting of IAPSO, Halifax, Canada. (E. C. LaFond, LaFond Oceanic Consultants, P.O. Box 7325, San Diego, CA 92017.)

Dec. 6-10 AGU Fall Meeting, San Francisco, Calil (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20000)

Feb 1-11 15th Pacific Science Congress. Dunedin, New Zealand, Sponsor, Universily of Olago. (Secretary-General, P.O. Box 6063, Dunedin, New Zealand.)

July 18-23 Fourth International Conference on Permatrost, Fairbanks, Alaska, Sponsors. National Academy of Sciences, State of Alaska. (L. De Goes, Polar Research Board, National Academy of Sciences. 2101 Constitution Ave., N.W., Washington, DC 20418.)

Aug. 15-26 18th General Assembly of IUGG, Hamburg, Federal Republic of Ger-many. (P. Melchlor, Observatoire Royal de Belgique, Avenue Circulaire 3, B-1180

Bruxelles, Belgium.) Aug. 27 Symposium Commemorating the 100th Anniversary of the Mount Krakalau Eruption, Jakarta, Indonesia, Sponsor, Indonesian Institute of Sciences. (Didin Sastrapradja, Deputy Chairman for Natural Sciences, L1P1 JL, Teuku Chik Ditiro 43, Jakarta, Indonesia.)

Sept. 12-14 National Water Well Association 35th Annual Convention and Exposition, St. Louis, Mo. (NWWA, 500 West Wilson Bridge Rd., Worthington, OH 43085.) Dec. 5-9 AQU Fall Meeting, San Francisco, Catif. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

# FUTURE AQU MEETINGS

**Fall Meetings** December 7-11, 1981, San Francisco December 6-10, 1982, San Francisco December 6-9, 1983, San Francisco

Spring Meetings May 31-June 4, 1982, Philadelphia

AAPG American Association of Petroleum AMS American Meteorological Society ASCE American Society of Chemical Engl-

GSA Geological Society of America IAG International Association of Geodesy IAGA International Association of Geomagnetism and Aeronomy

IAHS international Association for Hydrological Sciences IAMAP International Association of Meteorology and Almospheric Physics IAPSO International Association of Physical

Sciences of the Ocean IASPEI International Association of Seismology and Physics of the Earth's Interior IAVCEI International Association of Voicanoiogy and Chemistry of the Earth's Interior IUGS International Union of Geological Sci-

IWRA International Water Resources Associ-MSA Mineralogical Society of America

SEG Society of Exploration Geophysicists SEPM Society of Economic Pateontologists and Mineralogists URSI International Union of Radio Science

# GAP

# Aeronomy

Olio Absorption and scattering of radiation (pyrticles or wares)

\*\*SARINGIA DEC GASTREATINGS OF THE ATTENDATION OF A PROPERTY OF THE STANDARD STATES AND ADDRESS HOLE ASSORPTION PROFESS OF PRINCIPLE AND ADDRESS FOR PRINCIPLE AND ADDRESS OF CORDICAL ASPORPTION PROFESS OF PRINCIPLE AND ADDRESS OF CORDICAL ASPORTAGE PRINCIPLE AND ADDRESS OF CORDICAL ASPORTAGE PROFESS OF THE ADDRESS AND ADDRESS OF THE ADDRESS OF

# **Electromagnetics**

C/26 Electromagnetic theory

PMERICAL MITHORS FOR ESTABLISHING SOLUTIONS TO
THE INVESTE PROBLEM OF ELECTROMAGNETIC EMBOLITION
Report. I. Parker institute of Geophysics and
Planetery Physics, Seripps Institution of Oceaningraphy, University of California, Eas Diegs, La
Jilla, California \$2001) Mathrym & Mesler
A practions paper IFactor, 1902 sets out a
thoury for desting thether modulings establish the
inverse problem of electromagneth induction, and
outlines methnis for constructing conductivity
profiles when their esistence has been demonstrated. The present paper provides practical
algorithms to perform the membraney mateulations
stably and efficiently, concentrating exclusively
on the case of impresse conservations. The metter
of existence is treated by finding the bestfitting solution in a least-squares sense; then
the size of the misfit is tested atmistically to
determine the probability that the value would be
met or exceeded by chance. We obtain the optimal
solution by solving a constrained least-squares
problem linear in the spectral function of the
electric-field differential equation. The apertral function is conserved but no schalable by
transforming its partial fraction
representation into a continued fraction, using a
vable algorithm due to Mutiscauser. In addition
to optimal models, which slwaps coasist of delta
functions, two other types of model are examical
functions, two other types of models of the second
wird are sweath. A special func of the response
is chosen as that the product of conductivity
and thickness-squared to the same of the response
is chosen as that the series functions of the
Celiford-Levitan integral equation are degenerate,
thas allowing very stable and numerically efficient
schools are applied to magnetotelluris delay.
The mathritum scales in the second
wird are supplied to magnetotelluris delay.
The supplies and popular to

The Electrical Statement of the second statement of th To asset a transfer of the appropriate of the first and th

"11. Sti., Farer 181965

OTHER WALLSTON WAVE SCATTERING BY SPHEPOIDAL ORDERS IN THE A NETHER OF SPHE-WEIGHTED

naiff is Park. A Marino of SPHM-Wighted
Responding.

1. A. H. Futtrerm (Center for Relativity,
Department of Physica, The University of Tonas
at dust in, Austra, Ta 1872) and R. A. Matther
Vedescribe a technique for releviating wave
propagation adopted from the study of black
hole preturbations in meneral Relativity, and
illustrate its one by treating the scattering
of plane electrocapatic realization by prefectly
works tight a substantial propagation of plane electrocapatic relation of orthogonal
forcetions called sphe-weighted spheroidal herworked. The advantages of the technique are
that it suppresses the vectorial nature of the
problem and allows for simple application of
hymhary conditions. A specialization to the
ophorical case is made in order to compare orplicit analytical expressions to well-known
results.

PAL S. L. Paper 151064

# **Exploration Geophysics**

0920 Magnetic and electrical methods The Airborn's Electromagnetic Discovery of the DETOGR ZINC-COPPER-SILVER DEPOSIT, MORTHVESTER

THE AIRBORNE EXECTROMAGNETIC DISCOVERY OF THE DETOOD 21MC-COPPER-SELVER DEPOSIT, NORTHWESTERN QUEZET.

See 9170 North America
L. E. Band (Saico Mining Corp. Ltd., 55 University Ave., Suite 1700, Teronto, Oct., Canada M33 2H7).

In June 1974, a diamond detil operated for Saica Mining Corp. intersected zinc-copper sulfides in Broutling Tourship in marthwestern Quebec. To date, two bodies have been outlined. These bodies were discovered during a ground follow-up of a Mark VI input Belertromagnetic (2H) aurray.

The input survey cowered an area selected on the basis of regional geology and local outerope of acid volcanic rocks. Conductors were identified that appeared to be asseciated with potentially favorable geology. They were selected for ground follow-up, the was the Alscovery sone.

The sirborne responses over the two were less encouraging than those often observed over highly conductive measure of about observed over highly conductive measure of about observed over highly conductive worthwester. However, the theracter of the profiles suggested a badrock source.

Ground geophysical confirmation identified a drill targes.

Submedgemen to the discovery, more intensive geophysical surveys, both ground and airborns, were carried out, the base EN response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo correlated with the sarrly channel response from the halo corre

An airborne EX survey conducted in 1938 over the same area indentified both conductive zones. However, they were not followed up. Only with later edvacces in exploration philosophy, geologic appreciation, and instrumentation were the conductive zones recognized as viable exploration targets. GEOVHESICS, vol. 46, no. 9

# Geochemistry

controlled. As followed as Machania gray himself and the Stock (the plants of the control and the stock (the plants of the control and the stock (the plants of the stock (the plants) and the stock (the plants). So in the stock of the stock

# Izvestiya Atmospheric and Oceanic Physics

Natanson G. A., Toloknova T. A. Application of the Kazansky — Monin Theory to Models of Atmospheric Boundary Layer Yurchenko B. N. Experimental Investigation of the Temperature Field Spatial Structure at Turbulent Convection

Pinus N. Z., Litvinova V. D. Some Results of the Experimental Investigations of Microscale Turbulence in Layered Clouds

Yanovilsky E. G. The Radiation Field in Optically Thick Atmosphere with Nearly Conservative Scattering Conservative Scattering . Chuprynin V. I. On the Temperature Disturbances of a Fluid in the Nonstationary Velocity Field

Mikhailova E. N., Shapiro N. B. A Two-Dimensional Model of Evolution of Synoptic Disturbances in the Ocean

Kozlov V. F., Sokolovsky M. A. The Influence of the Cylindrical Topographical Disturbances on Unsteady Zonal Flow of Stratified Fluid in the Beta-Plane Zhurban V. M. On Viscous Stage of Turbulent Patch Spreading in Stably Stratifical Fluid. 

Sirakov E. On the Dynamics of Wet Non-Adiabatic Thermals above the Condensation Level . Gurvich A. S., Yurchenko B. N. Frequency Spectra of Temporature Fluctuations at Turbulent Convection

Boronoev V. V., Gomboev N. Ts., Zubritsky E. V. Optical Measurements of Intensity Plucuation Profiles of Refractive Index of the Atmosphere in Mounlainous Region

Mateshvill Yu. D., Rosenberg G. Y., Sandomiesky A. B., Sushkevich T. A. Investigation of Stratospheric Aerosol Stratification in the Soyuz — Apollos Program

Mateshvill Yu. D., Rosenberg G. Y., Sandomiraky A. B. Allitude Behaviour of the Air Scattering Coefficient in the Red Spectral Region by Measurements from Spacoship eSoyut-22s

Gordetsky A. K., Goldin Yu. A., Knyssev N. A., Malkova Y. S., Shvom E. M. Dotermination of Scattering Coefficient in Clouds by Measuring Reflected Lasser Pulse see Pulse ... I. Karlmova L. M., Korovchenko V. N. Spectral investigations of the Natural Aerosol Absorption
Konopasov N. G., Kunin V. N., Pleshivisev V. S. On the Possibility of Affecting
the Local Electric Field of the Earth by means of a Powerful Vertical Thermal Current
Thermal Current
Mirchina N. R., Pelinovsky E. N. On the Asymptotics of Wave Motions on Fluid 

CRITICS AND BIBLIOGRAPHY.

Kagan B. A., Chaltkov D. V. Book Review: Phillips O. M. The Dynamics of the
Upper Ocean (Cambridge University Press, 1977, 336 pp.)

Voit S. S., Gerodisov V. A. Book Review: Le Blond P. H., Kyaak L. A. Waves
in the Ocean (Elsevier Scientific Publishing Company, Amsterdam Oc.
ford — New York, 1978)

Actions Asterogram for the Seast Cibration experiment for the Seast Cibration and October 1978 by a group of Federal Company of Cibration for the Seast Cibration of Cibration and Cibration for the Seast Cibration of Cibration of Cibration for the Seast Cibration and Cibration for the Seast Cibration and Cibration for the Seast Cibration for the Seast Cibration for the Seast Cibration of Cibration for the Seast Cibration for the

sitragen is in chemical equilibrium [FByC (0.0010) = CK)((0.00) + K0)] with inorganic 80; and acts as received of inorganic 80; leasurement tabbads for PAN are currently available to verify those predicted results. Geophys. Ros. Lett. Paper 11.00%

1440 Geochronology (age determinations by radio-active processes)
A NEW INTERPRETIVE PROCEDURE FOR WHOLE SOCK U-Ph SYSTEMS, APPLIED TO THE VERBEROKE CRUSTAL PROFILE H. Welks (Bernsted Frice Institute of Geophysical Pensach, Bulescrive of the Winnerswood, Jan A NEW INTERPRETIVE PROCEDURE FOR WARDENER SOULE PARTY STREES, APPLIED TO THE WARDENER CRUSTAL PROFILE H. Welke (Bernsrd Price Institute of Geophysical Pansarch, University of the Witsearstand, Johnsmeeburg, South Africa, 2000) L.O. Micolaysen Genuille grade PraCambrian gnalsses have usually endergoes at least one paried of atrong U depletion. Whole rock U-Ph leatope studies can determine the timels of the aware depletion and this work attempts to place such studies on 4 more rigorous footing. 2-stage U-Ph systems can be described in terms of one major, episodic differentiation into rocks with varying U/Ph ration, while J-stage systems can be described by two such distinct episodes. Most of the PraCambrian granulitan which have been isocopically analysed have histories too complex to be described as 2-stage systems. Rowever, it is desconstrated hare that U-Ph date on whole rock suites can yield the complete U-Ph chemical history of a J-stage system (in terms of U/Ph ratios). For a suite of granulites, present day 20% by 20% by and 10% by 10% by ratios of chemical fine and an array. The degree of scatter in each of these 'peac arrays' is graphed as a function of time. The point of loant scatter denotes the age of the end of stage 2 in the history of the mystem. The script loant scatter denotes the age of the end of stage 2 in the history of the mystem. The script loant faction of stage 2 to be calculated. All other parameters in the system (in the parameters in the system (in the poperated during the differentiation spisodes. It is applied here to wantum-depleted granulitee in the deep ratio differentiation which may have operated during the differentiation which may have operated during the differentiation which may have operated during the differentiation spisodes. It is applied her to wantum-depleted granulitee in the deep ratio of the two fractionating episodes are esiculated at 380 km which may have operated during the differentiation of the crystalliae base-sout became to the lower half of the crystalliae b tittle significance for the lower helf of the crystalline bessent. Some fundamental features of Archaean betweent avolution, whose detailed significance is still poorly understood, wate elucidated for the first time by this U-Pb isotope study on whole-rock samples. Rocks which suffered little uralium deplation at the and of stage 2. Rocks which wate most affected at the and of stage 2. Rocks which wate most affected at the and of stage 2. It is a strongest deplation at the end of stage 2. It is a strongest deplation at the end of stage 2. It is a strongest deplation at the end of stage 2. It is a strongest deplation at the colorophism purges certain granulities of their U content but leaves others relatively unscathed. (U-Pb systematics, ProCambrian granulities, Interpretive procedure, 3-stage history).

J. Geophys. Res., Red., Fapar 181057

1. Seophys. Res., Red. Fepar 181037

1. Seophys. Res., Res., Res., Res., Res., Res., Res., Red. Fepar 181037

1. Seophys. Res., Res the Ah-Sr isotopic system in the felsic rocks and riccon U-Ft ages; an oplaced of arrong uracium depiselon affected both the felsic and mafic rocks of this enter ~ 2800 My ago. The minimum enteropy is the souther ~ 2800 My ago. The minimum enteropy arror with a long and complex history, beginning with the amplacement as a cruetal unit at least 1800 My ago. Since then it has been subject to reworking and reacting of isotopic systems which torminated ~ 2800 My ago. In the deeper trust there is scant avidence of a 3050 My acont. Similarly, there is no record of a ~ 2800 My ald imprint in the upper Vredicet crust. Thus, the isat major events that affected the goothemical constitution of the Vredefort upper and deeper crustal sectors differed in time and nature nevertheless that affected the goothemical constitution after the shoot isotopic setting in a domeward naving sequence, while the overlying crust remaided cooler, rigid and unaffected. These sevens probably reflect significant discounting in the cooling of the Archem crust. (Vredefort profile, inclupe bystematics, crustal avolution).

# **Geodesy and Gravity**

crustal avolution). J. Grophys. Res., Red. Capor 501776

1905 Artificial sate) lite techniques
110M, AND GEOGRIC OBSERVATIONS FOR THE
SASAY ALTIHETER CALIBRATION EXPERIMENT
John M, Diamante, Bruce C, Douglas, David L.
Porter, Robert P, Masterson, 197
(Mational Oceanic and Atmospheric Administration, Mational Geomic Survey, Rockyille,
Acalibration experiment for the Sesant
rader, attender was conducted to the Marmuda
1978 by a group of Federal Government
2016 as group of Federal Government
2017 by a group of Federal Government
2018 by Shell
2018

# **Separates**

To Order: The order number can be found at the end of each abstract; use all digits when ordering.

Cost: \$3.50 for the first article and \$1.00 for each additional article in the same order. Payment must accompany

Deposit Account: A minimum of \$10.00 may be placed on deposit with AGU for the purchase of separates, if funds are on deposit, the cost of the first article is only \$2.00 and \$1.00 for each additional article in the same order.

Separates will be mailed within 3 weeks of journal publication or within 10 days if ordered after the journal has appeared. Separates are available for purchase for two years from date

Copies of English translations of articles from Russian translation journals are available either in unedited form at the time of their listing in EOS or in final printed form when a journal is published. The charge is \$2.00 per Russian page.

> Send your order to: American Geophysical Union 2000 Florida Avenue, N.W. Washington, D.C. 20009

National Ocean Survey at an open coastal location on Bermuda to provide a determination of the instantaneous sea-surface height during the Seasat overflight of the island. The tide gage was geodetically tied to the laser tracking station on Bormuda, so that Seasat's position relative to the sea surface could be determined independently and compared with the value provided by the altimeter measurements. The root sum square (RSS) error in the determination of the vertical position of the laser, rolative to the sea surface, has been estimated to be 4.0 cm, exclusive of possible errors due to lack of pracise information on the elevations of the goold at Bermuda.

J. Gaophys. Ras., Red, Paper 151008

1950 Relation of gravity observations to

tectonice GRAVITY MODEL AND STRUCTURAL IMPLICATIONS OF THE GODCAND PENDANT, SIEFRA NEVADA, CALIFORN Edward A. du Bray (O.S. Geological Survey, Saudi Arabian Hission, APO New York 096971

California 94025)
A subsurface model for the Goddard pandant is constructed from a residual gravity high of about 7 mgal over the perdent. The model, which is the simplest and most geologically resensable simplest and most quologically resonable possibility, shows a measurephic black that tapers with depth and extends about 3.5 he below the surface. The structures in the Goddard pendent are similar in style and orientation to those in other Sierra newada pendants, indicating that the country rook was maither deformed nor cotated during pluton emplacement. Consequently, emplacement must have been a passive rather than three beautiful recommendations. a forceful process. The pendant itself represents a piece of country rock trapped

action. J. Geophys. Res., Red, Paper 180963

# Geomagnetism and Paleomagnetism

2560 Fime variations, pulsomagnetism FALEOMACKITIC COMMILIATION OF ... LIKE. IN RIVEN BASALT FLOWS USING SECULAR VARIATION 5. Boque (Earth Science Board, University of Californie, Santa True, CA 95064) and R. Coe A statistical method is dovoloped to evaluate stratigraphic correlations that are hased on the similarity of paleomagnetic directions. It involves comparison of the probabilities that such directions could have arisen by (1) simultaneous or (2) random meaning the probabilities one must extimate the effects of paleomagnetic errors and paleomacular variation, respectively. The method is tasted successfully on sections of 8-10 Columbia River Basalt (Grande Ronds) flows at Santinel Usp and Untanum Ridge, which are separated by only 25 km and contain two flows thought to be the same on geological grounds. Hore significantly, for yield apparent of sections at Sentinel Usp and Butter Canyon the analysis again shows that similar teneous magnetisation is a much more likely explanation of the general similarity of paleomagnetic directions than chance agreement of section field directions. The simplest interpretation of this result is that many of the flows at the two sites are the same, implying that series of Grande Ronde flows extended over distances of several hundred kilometers. (Peleomagnetism, corralation, Columbia River Basalt, secular veriation). J. Geophys, Res., Red. Paper 180966

2560 Time variations, paleomagnetism ZONAL HARMONIC MODELS OF REVERSAL TRANSITION FIELDS

I. Williams and M. Fuller (Department of Geological Sciences, University of California, Santa Barbara, CA 93106) Synthetic reversal records for differ-

ent latitudes have been generated for model transition fields with various fields are based upon a redistribution of energy from an exponential decay of the address dipole field to 92, 93 and 92. The records emphasize the dependence of their characteristics upon the latitude of the observation site. Both intensity and inclination changes, the relationship between these two aspects of the reports. and estimates of the time to complete the reversal are all strongly dependent upon latitude. A particular model in which of and of according to the ratio 2:316 15. musquito simulate the last reversal (Reverse), Model, Observation (Lead) (1805) (1805) (1805) (1805) (1805) (1805) (1805)

# Soviet Hydrology Volume 18, Number 1

VASILENKO, N.G. AND E.S. KHERSONSKIY, Flood Runoff Coefficients of the Rivers of the Central VASILENKO, N.G. ARUD S.S. MIRALING
Section of the Baykal-Amur Mainline
ZHUKOVA, M.A., Formation of Ice Jame and Their Distribution
ZHUKOVA, M.A., BOSTANDZHOGLO, G.V. VOROPAYEV, AND G.B. ORIN, Problems in the
Scientific Justification of Large-Scale Water-Management Practices for the Territorial Redistribu-

ACT SECOND RESIDENCE OF A PROBLEM PROBLEM OF A STREET OF A PROBLEM OF A STREET OF A PROBLEM OF A STREET OF A STREE

# Hydrology

III; Evapo;44ton TES DEE OF THE EQUILIBRIUM TEMPERATURE TO EMBLISE TEE HEAT BALANCE OF A WATER SURFACE

EMBLISH THE MEAN SALESHEE OF A WATER SALESHEE.

C. BORTH, (Laboratolro Asmonis de Météorologie
Fyaine, Complexe Scientifique des Cémeaux,
I seenes des Laodaie, SP 45, 63170 Aubière,
Fraccol, J. P. Albiquat and H. Tanke
From a series of 8) daily heat balances for
Na labe in Godivelle (Franco), daily estimates
of the rate of heating 6 (or variation in the
sur content of the lake are spelved by the of the rate of heating is for variation in the rat content of the lake are energised by the Lathon of gidinger at al. (1968), Keljman (1974) for equilibrium temperature. This enables the riculation procedure and the formulation of the schange coefficient K, and the equilibrium temperature T , to be distinguished which give the best estimate of the rate of beating. In Mitton the data are used to describe the daily nd seasonal behaviour of K and T for the coer and autumn stratification phases of the Ne. (Reat belance, water surface) h lotted Stiences Bull. vol. 26, no.2.

(ii) Groundwater

HER COUNTIONS TO COMMINATIONS OF LEARY, LAYER D.
ONTHOD, UNCOMFRIPT, MONIFORWARD ACTIVITIES

C. Lafe, J.A. Liquott, and P.L.-Y. Liu (Cornell
Singuist) Integral Figuration Buthod has priminly been used for linear, homosumous problems,
integrapher it has been applied to complex soulters in which the equal tons are non-linear.

Add equations are used to the at leaky, layered
\$1,000s. Astrix substructurion reintation offwho, and promite the use of lighted computers

fromy large problems. (Remadary integral equaconstand, baky sentions, layer of equility.

10 County). inter Pennys, Res., Paper 190903

A METROD FOR RESTRUCTING RECEASED AND ENGINEEY FLOW FROM GROUNDWATER LYSE OBSERVATIONS

LVML OBERMATICHS
F. J. Smith and R. S. Wikremerathm (Institute
if s,drology, Wallingford, own OXIO SBB, UK)
The astimation of recharge and boundary flux
is an important problem in deterministic
it-inheter modelling since these quantities are
it-inheter modelling
it-inheter modelling
it-inheter inheter inheter
it-inheter inheter inheter inheter
it-inheter inheter inheter inheter inheter
it-inheter inheter inheter inheter inheter
it-inheter inheter inhe They scale to those semiarid regions where a recy scale formulation can be used and relarge to confined to certain known areas. Ps inferred racharge method which assumes that they course in these areas only is compared with an elegrative method which does not see the confined with a starrative method which does not see The interest of the interest of the superior. It is formed to be superior. It is farmed to be superior. It is example of the interred recharge method dyllad to the Gan country losin, random train errors have been added to both water irals and transmissivities in simulation togetisant to assess the affect of errors in the data. The results of the simulations have been used to that the water than the simulations have been used to that the water than the simulations have ca att. The results of the simulations have believed to test the reliability of variance stimates derived from the theory. In addition, 'Estation' cases have been used to examine 's inferred recharge results. (Recharge, 'stimation, boundary fluxes) 'sticoline boundary fluxes)

NO Groundstar
LETRICAL RESISTIVITY-HORAULIC COMOUCTIVITY
GATIONSHIPS IN GLACIAL OUTWASH AQUIFERS
No. Urish (Department of Civil and Environstal Engineering, University of Rhods leland,
fouten, R.1. 0281)
Foolrical field relationships between apparent
forstion factor from surface resistivity soundlogs and hydraulic conductivity from pusping
this in fresh water granular equifers usually
see positive correlations. These relationships
can be adequately explained by theory if considstation is taken of in-stur field conditions.
A sound theoretical basis for relating
sparamet formation factor to pertinent hydrogeodysical parameters in hosogeneous isotropic
two is a three-phase parallel resistor model
clam esplicitly includes parameters of poreouter essistivity, grain size and shape,
borsity, turbussity, and intergranular surface
congulares. The verscity of the theoretical
tests is apported by data from imboratory
tests. The social demonstrates that intergranuits surface conductance is an important factor
to your grain grain size and high porewater resislivities, operating to lover the epparent formasolution conductance is an important factor result grain sizes and high potentiar resistivities, operating to lower the apparent formation factor. The model further shows that flexibility and formation factor are week in the first ange of potentiar resistivity, being firmly dependent on poresity.

"An extensity variation of in-situ porosity we stuffed leid curve relating apparent formation factor in hydraulic conductivity is shown a factor of everyly with the comparable curve in variation of state of the factor in hydraulic conductivity is shown in factor in hydraulic conductivity is shown in factor in the factor of the comparable curve in variation between squitar spagnent forestion where its land. Both theoretical and consistent of the state of the conductivity. Quantitative state is a large relation between aquitar apparent forestion incorrected interpretation and interpretation and interpretation in incortant aquifar parameters, all interpretation and inherent sections.

tuter Resour, Res., Paper W11017

lio Groundwater

Millio Groundwater

Millio Groundwater

Millio Groundwater

Millio Groundwater

Millio Groundwater

Millio Groundwater

Stage Academy of Sciencem, 11/3 Saddowaya
Darnogrysskya Sc. LOJO64 Moscow, USER)

Lidles Groundwater discharge to sees and

Groundwater discharge to sees and

Groundwater discharge to sees and

Groundwater outline

to hydrology and geology,

foas concepts and notions of groundwater cottlow

to the solids oceans are presented. A method

for washering subsarring groundwater discharge

yearlic Ocean along all its conscipine and major

slands ary own. The geograf, characteristics.

In discharge values are desarrined. The ground
water outlow to the Partific Ocean is shown to

follow latituding hymnographic yomality.

Froundwater discharge, Pacific Oceani & Shown to

froundwater discharge, Pacific Oceani & Shown to

following Solences hull, vol. 26, np. 1.

THE MAGNITURE OF THE HYDROLOGICAL PREQUENCY PACTOR IN MARIAGE PAGUENCY PACTOR IN MARIAGE PAGUENCY PACTOR IN MARIAGE PAGUENCY PACTOR IN MARIAGE PAGUENCY PAGUENCY PAGUENCY, USDA-SEA-AR, Beltaville, Maryland 207051 Chow's hydrological frequency factor, K, is used to compere and relars results and attach probabilities to several sets of marisms rainfall data. K is primarily a function of the recurrence interval for a particular probability distribution. K is displayed as a function of the mean of the annual marina for both official and unofficial rainfall observations and the probable maximum pracipitation (PMP) and MMP/2 for the Sexial 24 h durations. The magnitude of the unofficial observations appears to have a strong influence on the level of PMP. The quographical distribution of K for the lattur is displayed on maps for the maximum use attending the sexial use of the mouth to more than 15 in the morth for PMP and from about 7.5 to more than 17.5 for PMP/2. Probability seems to have vary little seasing for PMP or for the largest unofficial observations because these values are so rare that their recurred particular are several orders of magnitude greater than the langth of record upon which they are based. (Fraquency factor, maximum rainfalls)

Hydrological Sciences Buil. vol. 76, no.2.

OAN WE MODEL THE RAINFALL-RUNOFF PROCESS

TODAY?
F. Naef (Laboratory of Hydraulica, Hydrology and Glaciology (VAM), ETH Cantrum, CH-809)

F. Name (Laboratory of Hydraulica, Mydrology and Charlology (MAN), ETH Centrum, CH-8991 Zurich, Switzerland)

In the last two decades, camy rainfall-runoff models nave been developed, tested and the results published. Next of them give, as their authors claim, settlefactory results. But, given that the results are good, why do now models can time to be published? And why is the unit hydrograph still the cost widely used approach, although it is nothing its both anniversary. In the study presented bere, mydels of afferent complexity have been calibrated to three small basins (1.7, 10.9, 1.0) kn) with dense networks of recording rain-judges (0.4, 1.0, 40 nm², quopel and reliable stream javies. The results show that simple models can give satisfactory results; however meither the simple nor the more complex models thated were first from fallurs in contain casses, because pone of them adequately (Manish) the challest on the proved that coppes models que term results than simpler cass. (Rainfall-runoff medals)

(Rainfall-runoff medals)

1160 RUROLF and attendion THE EFFECTS OF MAN ON BASIN RUROFF, AND ON THE WATER BALANCE AND MATER STAGE OF THE CAPILAN SEA I. A. Shiklomanov ISta-a Sydrological tute, 2 Linija 23, 199053 Leningrad,

Instituta, 2 Linija 23, 199053 Leningrad, USSN).

This paper considers the effects of man on the runoif of rivers flowing into the Caspian Sea, bessed on long team observational data from the hydrometeorological network and on the analysis of experimental water belance data. Results of investigations of actual and future runoif variations in individual rivers (Tolga, Ural, Teres, Kura etc.) and of the total inflow into the Caspian Sea due to different types of sonomic activity are analysed; and the role comment influence on annual stages is estimated. [Water balance, Caspian Ses) [lydrological Sciences Sull, vol. 26, no.].

DIGO Remoff and streamflow OverLand Flow On a Divergined Superact N. Agiralingly and V. F. Singh (Department of Civil Engineering, Mississippi State University, Po Bow Drawer CE, Mississippi State, MS 19762)

Many basins in nature diverge or possess diverging slaments. White study formulates a diverging flow most uniting kinematic save theory. The kinematic equations are solved using a first order explicit finite difference achese, the model a tested using data on a number of laboratory basins reported in the literature. A comparison of this model with the plane model shows that they yield different concentration times and hydrographs that differ in shape, depending upon the degree of divergence. (Overland flow, diverging surface) Hydrological Sciences Pull: vol. 25, 20. 2.

ILEO Russif and streamflow
AMAPTIVE HYDROLOGICAL FORFICASTING

- A REVIEW
P. E. O'Connell and R. T. Clarke [Institute
of sydrology, Wallingford, Guon Oxio Gas, UK)
With the increasing use of telemetry is the
control of water resource systems, a considerable amount of effort in being devoted to the
development of social and parameter estimation
techniques for on-line use. A variety of models
and parameter estimation algorithms have been
considered, ranging free complex conceptual
toostar-space/Kaisan filter models which
to state-space/Kaisan filter models which
parhaps, have enjoyed undue popularity in the
recent literature due to their anthematical
recent interature due to their anthematical
request. The fundamental assumptions anderlying the various approaches are reviewed, and
the validity of these assumptions in the
hydrological forescating content is impassed.
The paper draws on some results obtained
of theiring a recomit workshop at the limitions of
theiring a recomit workshop at the limitions of
theiring a recomit workshop at the limitions
of different models and parameter
settimation algorithms; these results have been
derived from an inharcomparison of a number of
real time forescatting models. (Adaptive forecastlog)
hydrological Sciences mell, vol. 25, ho.2. resting) hydrological Sciences Suil, wol. 26, no.2.

3160 Resorf and Streamflow
LONG THE PROPOSES OF STREAMFLEN
POLICENS CITERS OFFERS AND RESORDERS
L. S. Marie; Jr. (Sunh Porsat Service,
Southeastern Porset Experiment Station,
Southeastern Porset Experiment Station,
Condets Sydrologid Laboratory otto,
Condets Sydrologid Laboratory otto,
North Carolina 3783) and M. T. Beach
Long turn changes in streamflow following
Long turn changes in streamflow following
forest systing are puserable for three experies
magnial history of Control Sydrologic Laboratory
Marth Caroline; Cont. Previous scalyses have

shown that, following forest cutting, streamflow increases and then declines with the
logariths of time as the forest regrows,
Secent data indicate ther the streamflow
decline following cutting is related to verstation regrowth, but the relationship is not
a consistent function of simple stand measurements. The mised hardwood forcest of one hasin
was clearcut twice in the past 40 years,
During the second regreth period attuanting
increases after the first year were about onehalf the increases at the same points in rise
after the first treateent. Concurrent with the
second cutting, two other basins were cut whose
sid-slevations are 400 m higher. The increases
for the upper basins were similar, even though
band area was reduced by only 650 on one.
Both streamflow increases were less than for
either cutting on the lower basin. Variability
of flow increases for the three cuncurrent of flow foregames for the three concurrent treatments to similar and appears parity soluted to precipitation. (Clearcutting, regrowth, atreasficw response) Hydrological Sciences Bull. vol. 26, no.1.

Sydrological Sciences Bull. Vol. 75, no.1.

3190 Sumoff and streamflow
A DISTRIBOTION FUNCTION APPROACH TO EMINFALLSUMOFF MODELLING
E. J. Score (Institute of Rydrology, Yallingford,
Onco STIO SBB, England) and H. T. Clarke
This paper begins with a critique of existing
rainfall-runoff models and proceeds to a largely
new formulation in which the simple store
(representing, for ensumple, interruption of
rainfall by vegetation, or, retention of water
in upper soil layers; or possibly both) is
replaced by a statistical population of stores.
The consequences of such an assumption are
in which the distribution of store depths is
asponential. It is demonstrated that the use of
a population of stores, even with but one
parameter, can (a) afford a plausible description
of the relation between actual evaporation and
soil molature deficit; (b) remove discontinuities
of gradient in the objective function,
optimization of which gives estimates of model
parameter. The new formulation also permits
chastred runoff to be written down as a
relatively simple function of past retainil,
potential evaporation, and the parameters in the
statistical distribution of atorages, with the
consequence that gradient methods can be used to
optimize the objective function in place of more
time-consuming direct search soldods.
As automation times and store depths. A simple
requisite equation relating current flow to a
proportion of the previous flow and an additive
function of rainfall he obtained under the
escusption that translation these and store
depths are independent and exponentially
distribution of two codels are derived by
relaxing the assumption of independence and by
considering distributions models are considered, and
the relation of the models and scomplayed in
conceptual models in alsemnial atructure
to different types of store commonly employed in
conceptual model line in a particular cames, all
imadels hased on liters assumed The

formulation includes, as particular cames, all models based on liters systems theory Application of the modelling approach to bootly values of flow, rainfall and evapouranapiration from a number of the institute of Rydrology's experimental bashes results to very good model predictions of flows over the cuitbration period, with R' values above 0.0 Knewers, this level of performance as measured by the R' statists in not menicated over the test period, sithough quite reasonable predictions of the flood peaks are attil obtained. The drop in performance is partly ascribed to the nature of the collaboration ported during which the basin were vetting up' after two years of relatively extrems drought. Model two years of relatively extrems drought. Model performance near the test period is topyword by uning a more resitute intensity conduction for the store contents, but only at the appears of reduced R' values in the calibration period. The need to assess the new model approach in a range of bydrological snavironsense is recognised, especially where evapouranapiration forms an important component of the basin exter balance and there the effects of not besture deficits on the generation of flood runoff can be espected to be greatest.

Water Resour, Pas., Paper V11019

3170 Show and Ice AREAL DISTRIBUTION OF SHOW WATER EQUIVALENT BY EMPH COVER HOMITORING J. Martines and A. Rusgo (Code 924, Guddard Space Flight Center, Creenbell, Natyland 2017), U.S.A.)

Space Flight Lanter, Creanbell, Artyland 2071, U.S.A.)
A method is proposed to determine the sreal distribution of the caximus seasonal water equivalent of snow in countain basims. Secause a sufficient density of direct seasurements is not available in recore, inaccessible areas. the securulation of snow at the start of the meting season is reconstituted. The disappearance of anow in grid units is munitared using landess data, the number of degree days necessary to melt the snow in totalizal, and the water equivalent of the snow selted is calculated. The reconstituted water equivalent values can be used to correct praclipitation measurements in winter. Together with finished polic measurements in winter. Together with finished polic measurements, these new west date can improve the evaluation of mow reserves for seasonal discharge forecasts, (Snow water equivalent, remote sensing, degree days, discharge forecasts).

Water Easour, Sno., Paper 191035

1175 Soil moleture THE MATER BALANCE OF THE BETWA THE NATH MOTA
J. V. Sutcliffs (institute of Sylrology,
Mallingford, Occo (RIO SBE, UK), R. P. Agrawal
and J. N. Tucker
A study of the water balance of a basin in
India, where the annual monacon season of water India, where the ennual monacon season or water sorplus contracts with a longer period of delicit, shows that estimates of soll moisture recharge and groundater secharge may be obtained in these circumstances by comparing seasonal nat rainfall with runoff on two assumptions; soil moisture recharge is constant from year to year, and groundater secharge is proportional to runoff. [Mater balance, Beyon] Bydrological Sciences Bull. vol. 26, po. 2.

Bydrological actories means to the second policy polarium urboring and Nickelse Parts For Street Call.

2011 Molerupe urboring and Nickelse Parts For Street Call.

21011/2101

7. J. Josten USBA-SEA-RA, Sydrology Leboratory, Pient Mayslology Institute, Naryland 20103, CMI.

7. J. Schwogen, A. D. Bicks, G. A. Coleman and E. T. Zedman Passarch has shown that it is possible to measure the soil moisture of the upper soil input using microsays remain seasing. This type of areal measurement, if obtained on a routine beaut from a space platform, could have value in hydrological missistence for microsays in hydrological missistence for transvolute in hydrological missistence for transvolute in hydrological missistence for transport and admittance of the upper appears of these data in modelling include parameter of actional point measurements of soil my parameter estimate soil woisture object measurements of avail soil woisture object measurements of avail soil woisture object measurements of avail to promit the form of microsays and post data. The possibility of using remotely sensed estimates possibility of using remotely sensed estimates of soil moisture with teach of soil as emperiment producted on several small basing located in thickness using the teach diverse parameter of microsays much basing located in thickness using the teach phydrograph Laboratory Model; of watershed bydrology. Periodic soil molecule samples obtained using conventional maileds were used to represent the type of

data remote mensing could provide. These data were used to evaluate the utility of periodic soil switter measurements for system updating. Analyses indicated the potential value of the data and supported its evaluation on a larger scale. (Pemote Sensing microwave, soil moisture) lightwingscal Sciences Buil, vol. 26, no. 3.

THE USE OF OPECIFIC CONDUCTANCE
IN STUDIES OF INTEGLE WAITERS
AND SOIL SOLUTIONS
I. D. L. FORKER (Department of Geography,
Covenity (Lanchester) Polytochnic, Priory
Street, Covenity (VI STR, LEF), I.C. Grave
and A. D. Christman

Especific confectaces (SC) is widely used as
a measure of mineral mait concentration and a
variety of models have been suployed which
relate SC to thick dissolver solids (TDS) and
icdividual ionic concentrations. This paper
attempts to mealures seweral models and highlights two major problems smeociated with them
from enalysis of water samples collected from
two small catchestes in East Dovon and North
Warvickabitz. Firstly, the presence of
dissolved organic material, at the levels
excountered in soil solutions, way seriously
affect the SC/TOS relationship and will often be
an undetected component of dissolved load.
Sacondly, the low pa of scase water samples is
shown to affect those models which calculate SC
on the basis of individual ionic concentrations.
This results from high S ison levels and
associated increased solubility of other lons,
such as Fm3\*, Al3\* and Am2\* which are not
cormally determined in water quality studies.

Especific conductance, soil water)
Eydrological Sciences Bull, vol. 26, no. 3.

## Meteorology

ONVECTION IN CATE

E. A. Have, Jr. (Department of Atmospheric Sciences, University of Veshington, Seattle) A. E. Betts

The difficult problem of parameterising tropical convection in large-scale andels of the atmospheric Besearch Program's Atlantic Tropical Especiaem (DATE), whose great matching of tropical convection and its role in the global streampheric circulation. A dense metwork of instrumented ships equipped with upper-six mounding equipment and quantitative weather reders were located over the Atlantic Ocean, in the Intertropical convergence some (FIGE), just west of equatorial Africa. The ship network was supplemented by a fleet of research sirrest and a geometrical Africa. The ship network was supplemented by a fleet of research sirrest and a geometric particular meteorological statilite. The data obtained show that the deep convoction in the 11st was concentrated in any spon of "cloud clusters", rapidly wowing squall clusters and slewly moving non-squall clusters. The clusters was characterized by large wideto-upper lavel cloud shipling, or "anvil clouds" that consisted from penetrative companies on each cluster was a legarity and experience of analist convextive ignature transing from colorate curvaloniabus in meteors. a lognormal spectron of analist conventive issu-tures ranging from nodorate curulonishos dom to tine non-pracipitating cumulus. The large cum-lenishus were typically grouped within a cluster into one or core econocale precipitation fea-tures (or MPP's) which were apparently triggred in resocale centons of intensitied low-level convergence. As an MPP matured it developed a region of stratiform pracipitation adjacent to the active deep convertive ceils. The strati-form pracipitation fail iron the anvil cloud. Associated with the stratiform percipitation and the delive doep convertive coils. The statiform precipitation fell iros the anvil cloud.
Associated with the attractions percipitation were
a measorate demarket below the anvil cloud and
an apparent resourche updraft within the anvil
cloud itself, aboys the mesostale downdraft.
There measorate drafts were distinct from the
convertive-scale updrafts and downdrafts of the
convertive-scale updrafts and downdrafts
(filled the planetary boundary layor in the vicimity of communication with stable art of low
coils static energy. These wakes of downdraft
air exerted a strong coatrol on where future
convection broke cut.

The results of SATE show that to simulate the
effects of tropical convection in large-scale
nouserical models of the atmosphere a variety of
phenomena must be secounted for, including, not
only convective-scale updrafts and downdrafts,
but envil cloude with masocale copyrights and convections and mesoscale copyrights patterns.

drafts, downdraft-induced boundary-layer trans-formations and measurable towards returns. Experimentation with ways of including some of those features of tropical convection in large-scale diagnostic and prognostic studies in unlexway, but much work remains to be done.

West. Geophys. Space Phys., Paper 181003

3725 Convection, turbulance, and diffusion USING RADAR TO ESIPATE DISSIPATION RATES IN THE LATERS OF TREALERICE J. Weinstock (Wational Oceanic and Almospheric Administration, Agronomy Laboratory, Boulder, Colorado 80303)

Administration, Agronomy Labolatory, Boulder, Colorado 60101) A method is described for estingting the energy dissipation rate, c, from raday measurements of the structure parameter,  $\Gamma_{\rm m}^{-2}$ . In stably stratified layers of turbulence. This estimate applies to horizontal layers of turbulence whose thickness,  $\Gamma_{\rm m}^{-2}$ , is less that the vertical resolution,  $\Sigma_{\rm h}$ , of the radar  $\Gamma_{\rm h}$  c within the turbulence layer and  $\Gamma_{\rm c}$  the average of c over the radar volume, are determined. The derived expression for c is based on a theoretical relation of turbulence layer thicknesses to the bacquarcy length.

POSITIVE CLOUD-TO-CHROWN LIVERS TO THE STORMS V. Runt (Mational Severe Storms Laberatory, MOAA, 1913 Halley Circle, Mouse, Chiabena 73065) D. McCorsan and R. Aracid The occurrence of cloud-to-ground flanks that

The occurrency of cloud-to-ground flambes that effectively lower positive charge to earth (+CG flamb) ever first extrain hes been documented in the mature stage of sewere themderatorne. Of the 11 documented +CG flambes, noch had easy one return atrobe. Earto-to-pack time times for the stroken averaged 7 us. The +CG flambes averaged 30 ms in duration, with 25 percent lasting more than 400 ms. Many of these had field changes puggestive of continuing current, Frestive flambes have been observed to emission from several regions of severa steemer high on the back of the main store tower, through the wall cloud, and from the downloads savil. Visually must of these positive flambes have semented from high in the storm, and accounting mapping of two shows thunder sources to a height of about 15 km. Gooders, Red., Lett., Paper 18052

3749 Gravity varys, tides, and compressional

1742 Gravity waves, tides, and compressional waves notested Transfer to the Interest Press. A Telesborn tests of the Interest Press. A Telesborn (Service d'Abronnaie du CREE, EP 3, 91370 Verrittes-le-buissen, France) F. Visi Propagation of the actospheric tides tesulte in a varticel flux of somal commune. This flux coaverges at altitude levels where dissipative processes take place. The deposition of the notestam contributes to the acceleration of the atmosphere resulting in 4 mean notal viol. The latitude distribution of this acceleration depends on the relative importance of the mechanical dan thursal dissipation is for instance, the first propagating mode, the mechanical dissipation of the latitude. Induction of the take place at 100 hm attitude, the first propagating mode, the mechanical dissipation is for instance, the first propagating mode, the mechanical dissipation of latitude. This inversion is shown to be imagreement with the available experimental data. (Hocentum transfer, tides).

J. Gaophys. Ras., Grace, Paper 100975

J. Gaophys. Res., Green, Paper 100975

1/10 Particles and acrotols TideB observations of Volcamic Clouds in THE Stantochier ower Bucker, Latero by Empiricas of ST. 31. MELTAS IN MAY 1990 M. Harono Octoartment of Physica, byoche University Followin 812 Japano M. Fujiwara, T. Shibata and M. Burnotol

Sudden increase of attatuspheric aerosols was observed by a Md-YA. Mair at the wavelengths 1.004 on fry and 0.552 on f. 2.5 giner June 4,1980 fall time 197 - CMT - 91. The increase is thought to be caused by the explosive eruption of M1.51. Release in May 1980. The initial increase began at about 15 by alkitude and the scattering ratio At about 15 bm alkitude and the scattering ratio at the wavelength F reached the maximum value on lune 5. This indicates that the serosol mixing ratio is about 70 times non-volcanic value at the same altitude. The estimation of the vartically incident direct solar radiction has been calculated to be 2ato-2 and 1.2ato-2 on the average for June and July, which are 4.6 and 3 times non-volcanic values in fall 'P9, respectively. After examination of the size distribution of Auranols inferred from comparison of profiles at the F and 5 wavelengths and with data by other measurements, it may be concluded that our lider has aven rela-S wavelengths and with data by other menurements, it may be concluded that our lider has seen relative time and apace warfations of mercacle fairly wait, but a little underextigated their abundance due to the assumption of clear atr at the stitude near 10 km. A plausible method of correction for the underestimation is described and the above extinction would be increased to 1,4~2 times. Global distribution of acrosol inventory is briefly estimated on the basis of the two dimensional analysis. (Volcanic ejecta, global dispersion, serosol size, climate). Gaophys. Sea. Latt., Paper 110817

3770 Particles and acrosols
300MERS HAMI-DHENT MEATOSMERIC ATROUGH
MASSERMENTS - 3 SIZE DISTPREUTION 1974-1979
J.L. brasitablend of Cloud Physics, CSIBO,
vidney, Australial Jaan F. Laby
The stratospheric mercual particle size
distribution has been measured at MPS, for the
period 1974-1879. Results from two measuring
and jet impaction - agree well. The size
distribution in shown to be described equally
well by sither a log-noisel or reso-order
logarithmic function. Charved distributions
agree substantially with model predictions for
r · 0 I be but undicate favor particles at
smaller radis. (Stratosphere, merosol, meathurn
hemisphere.)

# Mineralogy, Petrology, and Crystal Chemistry

J. Geophys. Ras., Green, Paper 100715

12's Variagements, petrographs and petrographs (IR Company March 11975) partition to petrographs (IR Petrographs III) with a 12's to the control of the cont

of the control of the decide B glasses are characterist by higher abalia, he area and lack of alement depiction and area are depicted and area expected at lack of alement depiction and area expected at the control of the same expect. The many element-carriation entitle rate by some case in arous 3, the moderant area in the picture rate in the legal and lack the model in class on a state of the same expected at the control of the same proposed at a small of following the definition of the same personal many as required skelding a final colid extraction in the proposed of the same protocol of the same protocol of the same protocol of the same protocol of the protocol of the same protocol of the protocol of the protocol of the protocol of the same colid glasses giving a total solar extract of old-li-figure and interest the color of the protocol of the protocol of the protocol of the same protocol of the the shift in these facilities are protocol of the same prot Color B glasses are chara terited by higher attacks, he from and leak of alemans depletion 1. Coupley Pey., 9-1, Tager 190415

A400 Paragnesis, patrography, and patrogensis 5.1178 Parritavate these retributes couling contributes as a couling parallel parallel patrogensis. Since the course of the parallel para to a capte tenting of alternia between regulating alternity and severalist in a mathematical to the several tention of the continuous several cule for action correctables profiles with: The arabes, his simples the casis of the the archive, I is given the control of the cold of the interface, or from the table of the mission and the archivet the mission and the two classes. The cold of the arctantactions in the two classes. The cold of the arctantactions in the two classes. It is considered that the cold of the first of the arctantaction and the control of the first of the cold of t

J. Geograps, Res., Red, Paper 190919

\$260 Paragenesis, petrography, and setrogenesis CONTANSTRIA EVOLUTION OF (ALC-ALVALIC VOLCANIC AND PLUTONIC ROCKS of MESTRIA CHIMDMAN, ARXIO W.C. Bagby, K. L. Carason (Board of Earth Sciences, University of Call Fornia, Santa Cruz, CA 95064) and Maryallen Caraton.

The sequences of conginantal-art Ignous rocks occur in the Batopilas aces of the Rierra Madre Occidental of corribettern Mosico. The older includes late Cruzecous to (1) early Canadok granifolds, and the jounger is a mid-Tortiery and site to rhyolics works that is represented largely by columbous Ignishritos. The latter sequence contains rocks willying from 5th to 78 mt. Side whereas the granifolds have a more restricted range in \$100, 57 to 58 mt. 8. The major element chamistry of the two sequences is generally similar; however, the older granifolds have loser Le/No, and higher No/f and R/No compared to volcanic rocks with similar \$100, in addition, the granifolds have generally smaller Eu anomalics, lower concentrations of REL, and higher (Ca/tb)y (1,5-1,2 vs 3,8-4,0) than the volcanic rocks. The intermediate rocks of the two sequences, quarted dorlots and andesities, had similar petrogenotic histories and both may have originated by fractionation of mantle-dorload batalitic ragenus. In concrete, the rore silicic rocks, granodicrites and not and dacties and rhyolites on the other, evolved very differently. The granodicrites have originated from a crustal source leaving a rest due of amphibolite or games granuflico, whereas the rhyolites were the product of protracted fractional crystalination of mantle-derived malts. (Marico, granitoids, rhyolites, peroposals).

J. Geophys. Rock., Paper 180732

A 760 Faragence in petrography, and petrogenous MANASLU LELCHARMITY: A COLLISION SIGNATURE OF THE MINELANA. A MODIL FOR ITS CENTESS AND PRELACEBLY.

1. Le Fort Kembro de Bechetchen Pétrographiques et desthimiques, BP. 20, 54501 Vandosuwra-lèuniques, Brance!

The Manaslu pluton is one of the ten leucogramitées that recur in the overthrusted Higher Hisalives iter the Indeferracija collision. Field and analytical data imiliate that the underlying mignative of the Tiboran Slab may be the piece where the incographic melts have generaced. The Hirslayen crustal thrusting of a hot Slab owns a rather culd vulcanous sedimentary pils (to Fort, 1979a) provides the merossery release of fluids. They cross the Mal, induce the partial manasals of the averlocated Tibotan Slab and produce a leucographic contraction of the service steel Tibotan Slab and produce a leucographic contraction.

of the overlocated liberan Slab and produce a learcognantity exposiThe explorement of the magma is located at
first along the min disharmonic plane above the
Mr. tetween the infrastructure and the superstructure. There it generates a convective hydrotherest system extending very far laterally according to the stratification of percephilities.
The progressive explaneous to fit be grantly accords as the convected fluids, including the
fluids relixed by the saturated agas, dissolve
the righty calcaterous host tocks of tibetam acidrentaries. A liveren longe of this "caving out"
progression is given be the extensive method for
grantic dylors outside the pluton.
The two quite independent fluid cycles of the
generation and of the coplacement have been triageneration and of the coplacement have been triasion. This sucfold model, deminated by fluid
activity crave to of importance for other laucogramins and symites.

I to phys. Pay. Ped. Paper 180320

A260 Fetrogenesis of grante magnes
CMEMICAL EVOLUTION OF PYCHAS IN THE PAGTEROZOIC
TERPANT OF THE ST. FRANCOIS MOUNTAINS, SOUTHEASTFARM MISSOURI, U.S.A., PART II. TRACE ELEMENT
DATA

R.L. Culters (Repartment of Geology, Fansas State
University, Manhatian, Janeas 66506, U.S.A.)
P.J. Aoch, M.E. Sickford
The St. Francois Fountains impress complex of
Proscouric age consisted hypodystal, grante
physions intruded into the overlying rhyolitan
of sinilar age. Maiting and crystallization
models of those rocks suggested by the field,
patrographic, and major element contents are
further refined using 8b, 8a, 5r, REE (rare-earth
element), In, Sc, and Co contents. There are
two groups of relatively undifferentiated plutons
associated with the Buller Hill caldera and Taum
Saus area that could have formed by aptical relaing of lower crustal rocks. The plutons associated with the Butler Hill Caldera (Romblick and
Silvarnine granites) could have formed by about
303 aggregate melting of a quart diorite, graywacke, or subgraywacks. The plutons associated
with the Jaum Saus area could have formed by
about 303 equilibrium reliting of a subgrayes or
arross.

with the Teum Sauk area could have forced by about 30s equilibrium reliting of a subarrese or artose.

More stilicic rocks of the Butler Hill calders could have forced by fractional crystallization. The Silvernine Granite is internally zoned. Crystallization of plagicalizac/hiotite/horn-blente/cagnatise/apattise/cytron/sphese in a ratio of 0.70/0.10/0.05/0.04/0.005/0.003/0.003/0.007 from the least differentiated portion of the Silvernine Granite could have forced intermeddiste portions of the Silvernine. Further crystallization of the Silvernine. Further crystallization of the Silvernine requires wore blotte (he begins to decrease) and less horn-blende, zircon, and sphone (HREE increase) to precipitate and form the most differentiated portions. Also fractional crystallization of undifferentiated Silvernine-type ragues could have produced the squarme of Butler Hill-Branitay-Granita-tille fractional crystallizing mineral assemblage is dominated by quarty. Fefole spar, and lesser plantechase. The Gerissoul Granitarite in the Huam Park area has the mineral assemblage is dominated by quarty. Fefole spar, and lesser plantechase. The Gerissoul Granitarite in the Huam Park area has the mineral assemblage and composition of a cuultate dominated from the Silvernine Granitarity edifferentiation sequence.

The state that distance focks could not have forced from other and created from the silvernine framite-type differentiation sequence.

Rather the vell-zone cache forced from the vell-zone forced from the silvernine force in a second and of the associated introduce notes.

Rather the vell-zone cache forced from the forced from the silvernine.

1. Camphys. Res., Pal. Paper 180902

4.7/4 Propursion of minerals
MICH-PRESCUE SIEUTURAL SIEUT OF DIOPSIDE
Ionize Favion IDepartment of Earth and Space
Sciences, State University of Heav York, Stony
Brick, New York 117441 and Charles T. Previte
diphyrosoure structural studies performed
on displaide at five pressures between 1 and
and 31 lbar show that the chrom polyhedra that
competes the structures, M(1), M(3), and 31,
decrease irregularly to size. The polyhedral
volumes of M(1) and M(2) both decrease approximately 32, whereas that of 41 decreases only
13. Comparison of high-pressure structural
churges of diopside and fassasite (apother
climopolosesson and more sitiscate-rhain
highing. Unit-cell parameters of diopside
charges from a = 9,7236(f) A, f = 6,199(8) A,
c = 3,616(5) A and f = 103,85(f) at 1 atts to
c = 9,612(2) A, b = 8,65(f) A, c = 1,193(2) A,
and f = 103,32(1) at 33,0 lbas. Increased
pressures has very little effect on equivalent
features show Tumbers' behavior with unit-cell
volume changes comed by 2 of f (M(1)-0,
-M(1)-9, 0(2)-31-0(1), and 0(3)-0(3)-0(3)),
wholess others do not (the 8 cell parameter and
derivable in, calculated from a weighted fix of
state, are 1,14(4) that and 4,3(1,8), respectively. The cuberness should be fixed of
state, are 1,14(4) that and 4,3(1,8), respectively. The cuberness should be fixed of
state, are 1,14(4) that and 4,3(1,8), respectively. The cuberness should be fixed or the fixed of
pressible direction (s), and the most compresstively. The cuberness should be a the least compressible direction (s), and the most compresstively. The cuberness should be a compressible of
the H-0 bonds can 1 to 1; and approximately 43°
between the temperature in parameter of
the H-0 bonds can 1 to 1; and approximately 43°
between the subject to 1; and approximately 43°
between the subject to 1; and 1; a cell, er 4270 Properties of minerals QUABTZ WITH RECHBOREDRAL CLEAVAGE FROM

GUASTY ATTH RECTORIERAL CLEAVAGE FROM MANAGASCAR C.L. Fichre (Institut für Pineralogie, Ruhr-Unversität, 46. Foobum, Germany) H. Kulke, H.G. Mielke and J. Jeithert Anhadral Quart: slabs from a wein deposit in Madagascar showing annoth cleavage planes parallel to positive rhomboedrar pinil) are described. Only two of the three equivalent pairs of the form [1071] show cleavage. Although of different quality (smoothness). The best developed planes its parallel to Brazil-twin inselles, the less well developed planes do not. We presume small tectunically induced thermal shocks to be the raleasing mechanism for rhombohedral cleavage fractures. In ombination with hydrolytic weakening and directed streas, large smooth cleavage planes were formed. Since the referee of quarts are F-faces, they have a minimum of free surface energy. We assume this to be the reason for cleavage parallel to positive rhombohedral faces. ("umrts, IT-Madagascar, win deposit, rhombohedral cleavage, structure and atrongth). strongth). Am. Hiperalogist, 66, 5-6

4270 Properties of cinurals and off-Ressure Censure. STRUCTUPE AND COMPRESSURE CENSUR. STRUCTUPE AND COMPRESSURE CENSUR. STRUCTUPE AND COMPRESSURE Of Server. Street Mineralty of New York. Stony Brook. New York 11794) and Charles T. Provitt Unit-cell and crystal structure parameters have been measured on a coesite single crystal at six pressures. Unit-cell parameters of coesite change from a - 7.1336(3) Å. h = 12.034(02)\* art 1 ero to a = 6.997(4) Å. h = 12.034(02)\* art 1 ero to a = 6.997(4) Å. h = 12.734(01)\* at 51.9 What. Both stilcate tetrahedra compress significantly but do not distort over the 52 kbar pressure range. All unconstrained \$1.0-31 angles and \$1.0-\$1 inconstrained \$1.0-\$1 angles and \$1.0-\$1 inconstrained \$1.0-\$1 angles and situates decrease over the pressure decreasing more than larger onas. Values for the bulk modulus [Rp = 0.96(3) Mbar) and its pressure derivative [Rp = 8.4(1.9) have been calculated by fitting the P-V date to a hirch-Hurnaghan equation of state. The compressibility of the coesite structure is highly anisotropic with the stiffest direction parallel to the chaine of tetrahodra, which run || to o, and the most likelibs direction | to these the line in the a-v plane. The creas-crossing of silicate totrahedral chains in the a-v plane, at different lovels along ... gives I an Intermediate compressibility.

The locreasing temperature (actor of 0(1), the

lovels along ", given " on intermediate companies bilter.

The increasing temperature factor of O(1), the contral anion in the 180° St-0-St angle, suggests that this angle becomes unstable at high pressures Eccause substitution of Ms for St has a similar effect on the structure as does increased pressure 500, may not exist in the coesite structure because the 180° Gs-0-Ge angle destabilizes the atructure, (Copatie, dismond-cul), crystal structure, elasticite).

AD. Himprelogist, 66, 3-4

QUANTITATIVE METHODS FOR ELECTRON MICRO-PROBE ANALYSIS OF SODIUM IN NATURAL AND SYNTHETIC GLASSES
C. H. Nielsen (JEOL U.S.A., INC., 11 Dearborn Road, Peabody, MA 01960) and H. Sigurdsson Two methods have been developed for the micro-probe analysis of sodium in natural and synthatic glasses that exhibit time-dependent element migra-tion during electron bombardment. A cryogenic method is bessed on the cooling of the sample to -90 degrees C, when sodium diffusion rate is near zero. An empiricial correction method determines the shape of the decay curve as a function of time during electron bombardment, which under normal operating conditions, gives initial socium concen-iration by extrapolation. (EPMA, Obstdian glass, cryogenic techniques, Alkali diffusion, accilum [038]. loss). Am. Wineralogist, 66, 5-6

# Oceanography

4765 Surface waves, tides and sea level TIDAL ANALYSIS OF INTERMITTENT ACOUSTIC OBSERVA

Tions

8. Zetler (Scripps Institution of Oceanography.

8. Zetler (Scripps Institution of Oceanography.

8. Jolia, California 92093)

Intermittent data from acoustic transmissions (hourly or bi-hourly every third day) to be obtained in an acoustic tonography experiment in 1981 will be analyzed for tides so that the tidal effert can be removed. Iwo methods of analyzing the tides (1) tidel interpolation errors 75 hours to patch the series. Followed by response analysis, and (2) harmonic analysis with corrections for interference by mearby constituents. Have teen tested with a real set of acoustic extended phase data. The results by the two rethods are found to be consistent and adequate, (Underwater sound, tides).

Gauphyn. Rem. Lett., Paper 110129

A763 Surface waves, tidan and see isval MEASURED INTRARED REDIATION AND TERM SEA HORIZON AND TERM INTERPRETATION - PRELIMINARY RESULTS A hem-Shalom (rai Aviv University, Department of Geophysics and Pianetary Sciences, Ramat Aviv, Iarasi) J. Ottersan and F. Schechnar The spectral rediances at wavelengths 7.8 - 11.5 he of the sea surface at assall angles below the horizon above a well defined minimum. The location of the minimum, its sharpness and ire magnitude depend on vavelength, see attac, atmosphanic turbidity, see and air temperatures. Remots seening of see attac appears possible by interpreting spectral rediances measured in a wartical seam of the see near the horizon. A closs proximity of the minimum to the horizon indicates a high see state. Seephys. Res. Lett., Papar 110364

Geophys. Rus. Latt. Faper 10364

3790 Instruments and techniques
APPLICATION OF GOES VISIBLE-INFRARED DATA TO
GOANTIFYING MESOSCALE OCCAN SURFACE TEMPERATURES
G. Rui (Mational Occanic and Atmospheric Administration, Atlantic Occanographic and Mateorological Laboratories, 4301 Rickenbacker
Causeway, Miaml, Florida 33149)
Application of GOES archived data to determining sea surface Lemperature in the Bulf of Mexico is investigated for October 1977, a period show two research ships and three environmental house were available to provide surface calibration data. A theoretical error analysis is first used to explain the persistent differences between ship and operationally-derived satellite temperatures, and then is used to dictate a technique for applying fuil resolution archived GOES visible and infrared data to the problem. The technique developed first remaps the satellite scanline data into a rectangular matrix which covers the region of interest. Second radiative transfer calculations are performed at each "cloud-free" station around the Gulf's periphery using LONGANA-4. Third, least Squares polymosal surfaces of atmospheric corrections are fitted to the parimetric radiative transfer results. Fourth, a bivariate Bayesian discriminant function, which uses cloud-free areas a training sets, is used to objectively classify clear ocean radiance measurements. Fifth, the GOES is calibrated by comparing is situ measurements with calculated theoretical satellite Lemperatures. Sixth, maps of sea surface temperatures ocean radiance measurements. Fifth, the GOES is calibrated by comparing is situ measurements with calculated theoretical satellite Lemperatures. Sixth, maps of sea surface temperature ocean radiance measurements. Fifth, the proports of the information of the inform

4799 General or miscelleneous COASTAL SUBMARINE HYDROTHERMAL ACTIVITY OPF NORTHERN BAJA CALIFORNIA-PART 11: EVOLUTIONARY HISTORY AND ISOTOPE GEOCHEM-

OPF NORTHERN BAJA CALIFOPNIA-PART III

EVOLUTIONARY HISTORY AND ISOTOPE GEOCHEMISTRY
V.M.V.Vidal (Institute do Investigaciones
Eléctricas, Apertado Postal 475, Cuernavaca, Morelos, México) P.V.Vidal, J.D.Isaaca
A geochemical model of the Punta Banda
submarine hydrothermal system (PBSHS) and
Ensenada quadrangle subacrial hot aprings
is developed using 'BO'160, D'M, 'BG'13,
'H., water and yas chemistry. The PBSHS
water is a primary high temperature, acid,
reducing reaction fluid of old seawater
origin which has been titrated by cold,
alkaline, groundwater of meteoric origin.
The final exiting end member solutions
represent a li mixture of the two primary mixing components. In contrast, the
subacrial hot spring waters are present a li mixture of the two
primary mixing components. In contrast, the
subacrial hot spring waters are open moteoric water. The subacrial hot spring gas
is predominantly atmospheric Ny while the
PBSHS contains large amounts of CH4 and
Ny derived from trapped marine sediments
of Cretacogous age, 'S values of sampled
hydrothermal waters are similar to Cretaceous marine sulfate values and suggest
the waters contacted Cretacogous marine
sedimentary strata. The presence of the
Alisitos and Fosario marine sedimentary
formations of Cretacogous age within the
Ensenda-Punta Banda quadrangles renders
support to this hypothesis. The data
also demonstratos that pyrite mineralization and deposition in submerine hydrothermal environments results from the
complexing of Ferrous from with elemental
sulfur and sulfide; and that submerine
hydrothermal activity acts as a major
source of stifice, Cal' and trace metals
and as a major sink for seawater Mg2\* and
soi, (Sutmarine hydrothermal activity,
geochemistry, isotopes, evolution).
J. Gsophys. Rss., Rad, Paper 181031

# Particles and Fields— Interplanetary Space

CORRELATION OF THE CORMIC-RAY INTERSITY WITH SOLAR-TERRESTRIAL PARAMETERS

J. R. Joktpil (Department of Planetary Sciences and Astronomy, University of Arizona, Tucson, Ar 55721

Shae and Smart (1981) have shown that the correlation between the Mt. Washington neutron conting rate and the geomagnetic as index changes significantly from the slaves-year period cantered on one solar minimum to the mext such period they suggested that this may be a manifestation of cosmic-ray drift in the interplanetary magnetic field. This letter raports the results of numerical simulations of cosmic-ray modulation, including drift, which verify that drifts can indeed produce the same of the observed effect. Factorbations in the helicopheric equatorial regions affect galactic cosmic rays observed near the equator more affectively if the corthern best pharm helicopheric magnetic field is invared than if it is outward. Parturbations in Kasre substantially more affective than perturbations in the solar wind velocity or in Kasre substantially more affective than perturbations in the solar wind velocity or in Kasre substantially more affective than perturbations in the solar wind velocity or in Kasre substantially more affective than perturbations in the solar wind velocity or in Kasre substantially more affective than perturbations in the solar wind velocity or in Kasre substantially more affective than perturbations. lance, geomegnetic indices). Geophys. Res. Lett., Paper 110870

Siid Coamic Rays
EMIANCEA COSIC RAY ANISOTROPIES AND THE EXTENDED
SOLAR MAGNETIC FIELD
D.B. Swinson (Department of Physics and Astronomy,
The University of New Movico, Albuquerque,
New Muxico 87131) T. Saito and S. Mori
Saito's two hemisphere model for the threedimensional magnetic structure of the inner hellomagnetosphore is used to determine the orientation
of the two solar magnetic hemispheres. Tais
orientation, as viewed from the earth, varies
throughout the yuar. The orientations during 1974
are presented, and are confirmed by satellite data
for the interplanetary magnetic field. These data
suggest a role for the field component perpendicular to the ecliptic plane, B<sub>2</sub>, in giving rise to
commic ray anisotroples detacted at the earth.
It is shown that an enhanced solar diurnal variation in commic ray intensity at the earth can
arise from the constructive interference of three
cosmic ray anisotropies, two of which depend on
the direction of the interplanetary anguette
field. This is demonstrated using commic ray
dats from the Nagoya muon telescope, and underground muon tiescopes in Bolivia, Bebudo and
Socorco. (Commic rays, colar and interplanetary
magnetic field).
J. Geophys. Res., Blue, Paper 1A0985 J. Geophys. Res., Blue, Paper 1A0985

5330 Electromagnetic radiation
A BEARCH FOR INTERPLANPHANY He 11, 304 Å EMISSION
F, Pareaco (Space Sciences Laboratory, University
of California, Berkeley, CA 94720), H. Fahr and

of California, Barkeley, CA 94720), R. fahr and G. Lay
A ragion of the shy around the antisolar direction in the Earth's shadow was systematically surveyed for the first time at high sensitivity and angular resolution by the astreme ultraviolet telescope on the Apolio-Soyus mission. The signal from the 170-520 A channel of the instrument, which is sensitive primarily to the Me II, 304 A and Re I, 584 A remonence lines, shows a sharp decrease in intensity as the line of sight wasps into the shadow ragion. Once the line of sight is completely contained within the shadow examinated within the shadow as small residual algual show instrumental background and independent of view direction and spacetraft position is observed. Its intensity is commistent with the expected signal from the interplanetary He I, 584 A smission measured by the 500-780 A thousel of the actrees ultraviolat telescope. An upper limit at the 20 confidence level to a possible He II, 304 A component that cam ascaps desection by our instrument corresponds to 0.02 Rayleighs (1.6 x 103 photons cm. 2-1 ar-1) or to a column density of 19 ins cm. acattering at line canter. This flux could conpends to 0.02 Rayleighs (1.6 x 10° lons capeal art 1) or to a column desutty of 10° lons capeal art 1) or to a column desutty of 10° lons capeal art 1. Or 10° long capeal art 1 J. Geophys. Res., Blue, Paper 1A0874

5350 Soler wind interaction with moon and planets
THE DISTART BOW SHOCK ARM MAGNETOTAIL OF WENGE.
MAGNETIC FIELD AND PLASMA WAVE OBSERVATIONS
C.T. Bussell (Institute of desphysics and Planetary Physics, University of Celifornia, los angeles, Celifornia 90024) J.G. Lamand, R.G. Elphic and Fib. Scarf.
An examination of the magnetic field and planetary acts obtained by the Pioneer Vapon orbiter in the wake region behind Vanus discloses a well in the wake region behind Vanus discloses a well in the wake region behind Vanus discloses a well in the observed on previous missions in contract that observed on previous missions in contract the dayside box shock. Vanus and so help well is otherwise, were magnetosheath wellums and in which the memorate field in altered approximately developed magnetopeal in which the idea and in the control of your magneton beath we live a magneton with the life of approximate with the magneton of free ion. The boundary between magneton beath and magneton that is also between magneton beath and magneton that is also were party lipitations (Yenus; solet whole) interaction; comet, dagneto (1914) bey should be the solet of the

Particles and Fieldsionosphere

3100 Solar wind magnetic fields
pg SECCO EFFECTS ON THE POLAR GEOMAGNETIC FIELD
pg SECCO EFFECTS ON THE POLAR GEOMAGNETIC FIELD
pg Sector effects on the polar geomagnetic
also of the geomagnetic data from 13 northern
a use of the geomagnetic data from 13 northern
at 6 southern high-latitude geomagnetic stations.
An interior effects near 70° invariant latitude is
sector effects near 70° invariant latitude is
sector effects are 70° invariant latitude
is entitled. A method to improve the sactor
invaligated. A method to improve the sactor
invaligated. A method to improve the sactor
invaligation from geomagnetic data is suggested,
and formation of the winter reversal is briefly
insused, taking electric-field propagations
issused, and the propagation of the propagations
issused, taking electric-field propagations
issused, and taking electric-field propagation 3505 Airglow
OBSERVATIONS OF THE CA\* TWILIGHT AIRGUM FROM
UNTERMEDIATE LATERS OF IGRICATION
C. A. Tapley (Space Physics Research Laboratory,
Department of Almospheric and Oceanic Science,
University of Michigan, Ann Arbor, MT 48109)
J. D. Macheum, J. W. Mariwether, Jr., and
J. C. G. Nalker,
Application of Authority and Applications of Applications

1370 Solar wind magnetic fields
PROPERTIES OF WHISTLER-MODE WAVER
BETWEEN G.3 AND 1.0 AU FROM HELIOS
005ERVATIONS
H.b. Beleroth (institut für Geophysik
and Metaorologie der Technischen
Universität Braunschweig,
0-3100 Braunschweig, Germany) and
8.4. Nauhauser

p-1300 Braunschweig, Germany) and
P.M. Neubauer
A study of magnetic fluctuations in
A study of magnetic fluctuations in
the solar wind in the distance range
from 0.3 to 1 AU and the frequency range
4.7 Hz - 2.2 kHz by the Technical University of Braunschweig search-coil magmetometer experiment onboard Helios 1
and 2 during the time intervals from
December 1974 to April 1975 for Helios 1
and January 1976 to May 1976 for Helios 2
yields the following results:

I.) Near I AU electromagnetic wave modes are restricted to frequencies less than 220 Hz for 991 of the time. In-side 0.5 AU the waves are restricted to less then 470 Hz in 941 of all

cases.

1.) For a spectral density /P(f) = for with the quantity /P' measured in aT/Mz the spectral index o varies between -1.4 and -2.0 with a most probable value of -1.7 and a slight tendency towards steeper spectra.

between -1.4 and -2.0 with a most probable value of -1.7 and a slight tendency towards steeper spectra towards the sun.

3. No clear corrolation between simple plasms parameters and magnetic field agaitude Fon one side and spectral densities on the other side is found. The proportionality between spectral density and f is simply attributed to the radial variation.

1.) High wave intensities occur in the vicinity of stream interfaces with a decrease in wave intensity with increasing distance from the stream interaction region.

3.) Magnetic field energy density above 4.7 Mz varies between 5x10-18 erg/cm<sup>3</sup> and 10-14 erg/cm<sup>3</sup> with a maximum of occurrence of 5x10-18 erg/cm<sup>3</sup> near 0.1 AU. The values are therefore orders of magnitude below the total neghetic field energy density.

3.) The fluctuations are tentsitively interpreted as locally generated whistler waves. (Solar wind, magnetic Spectra, whistler-mode waves).

1. Caphys. Fes., Blue, Paper LAGSS2

Sity Solar wind please SILOR. IND. TORS IN HIGH SPEED SOLAR WIND SILOR. IND. TORS IN HIGH SPEED SOLAR WIND SILOR. IND. TORS IN HIGH SPEED SOLAR WIND SILOR. IN HIGH SPEED SOLAR WIND SILOR. IN HIGH SPEED SOLAR WIND SILOR. IN HIGH SOLAR SOLAR

IIII Solar wind plasma
IDMTATURE ANISOTROPY INSTABILITIES DRIVER BY
YANYS ION MODEL
A.F. Lewbare (SLAN/Godderd Space Flight Center,
A.F. Plasma Instabilities driven by proton
taperature anisotropies are investigated
(kretically using Menag's ion model. i.e.,
tas: flux-modified non-Nerwellian velocity
disribution Functions. The linear dispersion
properties are studied in an infinite Visaov
Hims where the proton distribution is assumed
it cansist of one warm slow speed occuponent and
the electron beckground is instropic. The
twenters are obeam socording to Whang's solar
visit ion side!. It is shown that the fire hose,
alrow and Herris in matchility do not occur under
this conditions. The only unstable mode is the
ins excitations and Crowth rytes are found to
tape values, between 2.1 · 10° (T./T. = 2) and
1.1 (T./T. = 0.15). (Temperature
embropies, heat flow, distribution functions,
Matchilities).
J. Caophys. Ras., Blua, Paper LAGVA3

J. Capphys. Res., Blue, Paper 140743

130 Solar wind plasma "LIT-SPACECRAFT OSSERVATIONS OF HELIOGRAPHIC MITHUR-LENGTHOR STRUCTURE IN THE SOLAR WIND Lind J. Modes, IT. and Palmand A. Serial

fation, 1., Blue, Paper 1A0080

J. C. G. Malker

Application of complagatary optical and incoherent scatter redar two inques has descated
the presence of Ce in lower thermospheric intermediate layers over Araciba. The altitude distribution and density of the calcium on is
inferred from the weriation of twilight resonant
catacting with solar depression angle while the
Arecibe 430 Min radar measured electron densities.
Comparison between the Ca and electron column
densities indicates that the composition of low
altitude intermediate layers was 27 Ca. This
wells is consistent with both rocket mass apaccrometar measurements and with the relative concentration of calcium expected for mesonic
debtis. These results have implications regarding both possible nighties tropical E-region
lonization sources and metal ion circulation in
the tropical thermosphera.

J. Gasphys. Las., Blue, Paper 140936

5616 Auroras
ACCELERATION OF HEAVY 10/85 ON AURORAL FIELD LINES
M. Ashour-Abdalla (Institute of Geophysics and
Planetary Physics, University of California, Los
Angeles, CA 90024). H. Obuda and C.Z. Cheng
We present results of both a linear and a nonlinear study of oxygen cyclotron waves and the
associated oxygen heating. Linear theory predicts that oxygen cyclotron waves will have
emailter growth rates than hydrogen cyclotron
waves. Results of a simulation study in which
the free energy source is an initial drifting
electron distribution indicate that oxygen cyclotron waves only grow to small amplitudes, while
the hydrogen cyclotron waves achieve larger amplitudes. In an attempt to model more realistically the continuous isomospheric outlow, a simulation model is used, in which the electron velocity distribution is maintained by a constant
flow of electrons. This latter model predicts
that the oxygen waves graw to amplitudes much
larger than the hydrogen waves resulting in the
preferential heating of the heavier lons.
Geophys. Res. Latt., Paper 110820

Geophys. Res. Lett., Paper 110820

5530 High-lat(tude lonospheric currents

5530 High-latitude lonospheric currents
FELD-ALIGNED CURRENTS AND THE STRUCTURE OF THE
AURORAL EONE LONOSPHERE
A. Heulka (Receberg lustitute of Astrophysics,
National Research Council of Canada, Ottowa,
Canada Kila ORA:
A general formula supressing the density of the
magnetic find aligned current (FAC) in a partially ionized gas as a function of other physical
parameters is derived and its approximate form,
suitable for lonospheric avuides, is disrussed.
Changes of the FACs in the tonosphere depend
on the properties of the vottor G representing
the total sechanical force acting on a volume of
a multi-component ionospheric "finid"; div ja,
and consequently div ja, is different force acre
if and only if Becuri G fo. Hearing of the survey
ral lonosphere, and a high-alitude enhancement
of the attrospheric density associated with ir,
produces verticity of the G-field which to consethe industrial advectors of the FACs observed above
the lonosphere.

the isomorphere.

Waristica of E, in the autoral isomerous is determined from the pattern of \$1 and tree the generalized Oir Toy.

J. Goophys. Post, Blue, Paper 180954

5530 High-laticude lonospheric currents
DISTANT MAGRETIC FIRID EFFECTS ASSOCIATED WITH
BRAFILAD CUPPENTS (MAR POSSIBLE BY THE
EVALUATION OF TAIAD'S ATLIBUE MISCILLATIONS)
GEOURG Gustafeson, T. A. Folence and S. Favin
I'the Johns Hoptine University Applied Physicu
Laboratory, Learsi, Marviand 208101, and N. A.
Saflake.

The magnetic field data acquired by the TRIAD
satellite sometime show variations with periods
longer than ten minutes and with amplitudes of a
few thousand nT due to attitude socillations.
From a study of 150 passes, the principal
oscillations of TRIAD have been identified as
the well known librations of a gravity
stabilized satellite. The libration sprince
approclustely T,72 and T,641, where T, is the
amplitude and phase of thems libration appear
to change over pariods of a few days, and sometions vanish sitogether. Using data acquired
over several consecutive TRIAD arbits, these
stritude variations can be numerically evaluated
and removed, leaving the disturbances associated
with Birkeland currents. The establishment of a
"base-line" for the TRIAD observations using
this technique has permitted, for the first
time, a preliminary svaluation of the "currentfree" magnetic field disturbance due to largescale Birkeland currents. Data acquired from
three consecutive TRIAD passes (spanning more
than 3 hours) show nearly the same aspectic
disturbance profits which extends as far as ten
degrees in latitude from a single (out) region i
Birkeland current sheat. These observations
confirm the permannt and global nature of
large-scale Birkeland currents.

J. Geophys. Res., Shus, Paper IA1074 J. Geophys. Res., Blue, Paper 1A1024

5560 Low-latitude ionospheric currents
5-60 RETERS WAVELENGIN PLASMA INSTABILITIES IN
THE EQUATORIAL ELECTROSET 3. COUNTER-ELECTROSET
CONDITIONS
C. Hanuise and M. Crochet (Laboratoire de Sondages Electromagnétiques de l'Environnement Terrestre, Université de Toulon et du Var - La
Giponne - Bd des Armaris - 83100 Toulon, France)
Measurements of plasma (natabilities in
the equatorial electrojet with HF and MF radars
have bean always performed in a large scale
turbulent medium. It is only in the exceptionnal case of a strong daytime counter-electrojet,
as observed in Africa in 1977, that the background can be considered as almost hasimar.
Characteristics of the instability during such
conditions are presented and appear to be completely different from those observed dering
electrojet conditions; especially the measured
phase velocity varies with elevation apple and
wavelength as predicted by the linear theory.
The level of turbulence deduced from the measurments is found to be weaker than during uspal
conditions. Comparisons are made with theoretical
works.

L. Gernbyer, Res., Blue, Paper 140878

5.60 Particle Freeipitation
NIGHTIME OBSENVATIONS OF 0.2-26 KEY KLETHOMS IN
NIGHTIME OBSENVATIONS OF 0.2-26 KEY KLETHOMS IN
THE SOUTH ATLASTIC ANOMALY MADE BY AMPOSPHERE
EXPLORES.

J. A. Oladhill (Laboratory for Planetary Armopheres, Codderd Space Flight Center, Creenbalt,
spheres, Codderd Space Flight Center, Company
south the figures and spheres of the low-energy
special se with any degree of Certainty, and as a
particles with any degree of Certainty, and as a
particles with any degree of Certainty, and as a
particle to made for the centry inness is back
found that the flux of low-energy inness is back
special to use the low-energy inness and
abled use to use the low-energy heatground, and for
correct the response of the low-energy alectron
deactor for this, "The electron special and
beactor for this, "The electron special and
beactor for this, "The electron special and
charter for this state and
particle to the state in Amelia of the state
over the South Atlastic Movement, The span
years of the Countries of the Laborator of the South Atlastic Movement,
Anomaly is found to be about MIO sepace,
A surprising require is that this energy flux deand pay reach five thems this walks on years
and pay reach five thems this walks on years
and say reach five thems this walks on years
and say reach five thems this walks on years and
a surprising require the that this energy flux de-

Izvestiya Physics of the Solid Earth Volume 16, Number 2

### CONTENTS

At Garm region  Kopnichev Yu. F. Statistical models for generation of coda and Lg phase and the results of their joint interpretation  Shtemenko Yu. N., Tsybulsky V. I. Efficiency evaluation of seismic systems  Strakhov V. N. Equivalence in gravity inversion problems and possible implications for interpreting gravity anomalies. I  Blokh Yu. I. Estimation of magnetic field for two-dimensional anisotropic arbitratily shaped bodies including demagnetization effects  Vanyan L. L., Berdichovsky M. N., Vasin N. D., Okulessky B. A., Shilovsky P. P. On normal electrical resistivity structure within the Earth	10 22 30 44 65
SCIENTIFIC COMMUNICATIONS	
Simakov G. V., Trunin R. F. Shock-wave compression of minerals Burymskaya R. N. Fault-propagation velocity within an earthquake source Burmin V. Yu. Convex-spline approximation of a seismic travel-time curve Mudretsova E. A., Dorofeyov I. F., Tselev V. I., Filatov V. G. Analytic continuation of gravity field into lower half-space by means of regularized continuation Afremov L. L., Belokon' V. I. The effect of mechanical stresses on magnetic states and critical field of single-domain particles Shaub Yu. B., Barinov N. N., Starzbinsky S. S. Electrical-to-magnetic energy density ratio of magnetotelluric field and source characteristics of the field	77 82 90 97 101

CHRONICLE Epinatjeva A. M., Yurov Yu. G. Efficiency and perspectives of seismic refraction

Melodensky M. S. On excitation of normal modes of the rotating Earth . . . . Lukk A. A., Nersesov I. L., Yunga S. L. Temporal variations in focal mechanisms

Aleshin A. S. A step forward in right direction. («Sojsmic methods in engineering geology», by N. N. Gorjayinov and F. M. Ljakhovsky.) 55M Jotal Mectron content Ministripe. Limitato 2001; and total Ministripe. Limitato 2281 of total photosphility. Limitato 2001; and total photosphility. Limitato 2001; and total photosphility of the property of the Albert Parkon of the prophysical langitude. University of the Albert Parkon of the Albert Parkon of the mighteriors electron content during substitute. The probability of their occurrence in relative at the mighteriors electron content during substitute. The probability of their occurrence in relative at the majority of their occurrence in relative at the majority of their occurrence in relative and there are many little to be observed when the delity sum of K indices exceeds 20 in winter of the severe. There is a research to the occurrence of the observed and the occurrence of the occurrence occurrence of the occurrence occurrence of the occurrence the one solar inition in which a test of the litter extent of the neutral line was possible. The regermaneter results and the define data seas that the sector headily surface profully extended to all in the morthers head, here and to all in the sectors, which little change totaken 1.59, and 1.40 the surface was exceed approximate for the surface titled place (i divide configuration) varieties a significant resulting a significant resulting a significant resulting and descent control.

Lytten (Miko), 1 M., P. H. Scholmer (E. L. D. Deskold), The conjugation who while Hellequeets representations, Schedul, in press (1901).

5590 Instruments and techniques ELECTRON TEMPERATUPE MEASUREMENTS BY THE PLASMA LINE TECHNIQUE AT THE PRENCH INCO-HERENT SCATTER PAYAD FA'ILITIES

PLASMA LINE TECHNIQUE AT THE PRENCH INCOHERERT SCATTER PRANCE AT THE PRENCH INCOHERER SCATTER PRENCH AT THE PRENCH INCOHERER SCATTER PRENCH AT THE PRENCH AT THE PRENCH AS THE PRE

Particles and Fields-

5703 how shock waves
UPSTREAM EMPRESTIC IONS AND ELECTRONS; LOW SHOCK
ASSOCIATED OF MACRITOSTREAM COLICIAN.
A. Sobbier (Max-Finack-Institut for Estraterrastrinchs Physis, 0-8046 Garching, W.-Germany)
W. Bowssiedt, F.N. Igavich and G. Glockler
We have analyzed 13 proton bursts observed with
the Kax-Planck-Institut/Marwersity of Maryland

Magnetosphere

J. Geoghys. Res., Blue, Paper 1A1026

5710 Solar wind megnetic fluids
THE CORONAL AND INTERPLANETARY COMPENT SHEET IN
EARLY 1978
L. F. Burlags (Godden' Space Flight Center: Laboratory for Extraterrettrial Physics, Graenbelt, MO
2077)] A. J. Handansen and Zhao Jwe-pe
A comparison of Haliot i and 2 observations of
the interplanetary sector pattern in early 1976 with
the maximum brightness curves in the K-cornameter
date 41.58g shoot that the latter may be identidate 41.58g shoot that the latter may be identifield with the loopoints of the sector boundary
field with the loopoints of the sector boundary
field model; using a six-month average of ME. Wilson
photospheric magnetic field measurements and a
source surface at 2.58g, is smilter in shape to the

R-coronameter maximum brightness curves but extends to higher last tudes. The Hellos observations give better agreement with the K-coronameter curves for

STA classic fields

INFEL OF APPARENCE OF ELECTRISTATIONS AS INC.

WHOMAL COME FIRED CLASSIC FIRED CLASSICS AND SIGNARY

FAMIL

5. S. Homer Classics Communication of Communicat

F. S. Three Problem 1. Common 1. Type of terms the continuous and type of the continuous and type of the continuous and type of the transfer o

5715 Electric fields
DEPENDENCE OF FOLKE-CAP PUTENTIAL PROP ON INTERPLANETARY PARAMETERS
P. H. Reiff (Dept. of Space Physics & Astronomy,
size University, Nouston, Teras 770-11) B. V.
Spito and T. W. Mill

lice University, Nowaton, Tenas 770-11 E. V. Spire and T. W. Mill

We have computed the convection potential dropaccess the polar cap from data obtained on highinclination low-sittude satelities (AZ-C, AZ-C,
13-1) and correlated these potential measurements
with various combinations of parameters measured
similar-causely in the upstream solar wind. These
combinations of solar-wind parameters consist of
predictions based on magnetic merging theory are
suggestions based on magnetic merging theory are
suggestions based on magnetic magnetic field
(IMF) parameters, are successfully predicts by
merging theory (to the accuracy with which they
can presently be measured), but that a significant "background" potential drop (- 33 kV) does
not depend on IMF parameters and may thus be
stributed to an unknown process other than
merging. Our results indicate that small values
of the IMF are amplified by a factor of 5-10 at
the dayside megnetopause as a combined effect of
but shock compression and the Zenn-holf dapletion
layer effect; correlations between IMF parameters
and the polar-cap potential drop are dramatically
improved when this amplification is taken into
accounts. The potential drop has dramatically
improved when this amplification is taken into
accounts. The potential drop has dramatically
improved by non-linear responses of the magnetosphere to the polar-cap lapat.
Loophyne, New, Blue, Paper Laide2 sphere to the poler-cap laput. J. Geophys. Res., Blue, Paper 141042

1713 Magnetopause
1818-1, -2 ANG -3 ORRENVATION OF THE INTERACTION
18THERA M INTERPLANATARY SECON AND THE RATHS'S
ANGEROSPHENES A BAPID THAVESTAL OF THE
MAGNETOPHENE A BAPID THAVESTAL OF THE
MAGNETOPHENE AND INTERPLANATARY SECON AND THE RATHS'S
ANGELES Fingling, University of California, Los
Angeles, Chi, McGivelson, C.-Thaussil, and
E.J. Beith;
The interaction between an interplanetary
shock and the earth's magnetosphere was observed
by 1828-1 and -2 on August 21, 1878. The two
spacecraft were initially inside and near the
nose of the magnetosphere, separated by about
1899 km. The about, identified by 1812-3,
resched the vicinity of the earth in
approximately helf an hour. As a remult of the
interaction the magnetospheric boundaries wowed
repidly dertheard, so that in less than three
similar both the magnetospheric boundaries wowed
repidly dertheard, so that in less than three
similar both the segmetospheric bring the over the IEEE-2 and -1 spaceuraft. The
falsy butteen the two spacecraft piled a
boundary appead of 195 hayses for the
sagnetosphene. The august locally large speed
provided a rapid sean of the boundary at the
time and place of observation, but important
differences in boundary structure existed in
deta taken 5 seconds apart by the two
spacecraft. A retational 1950 was agened
present during the 1822-2 crossing and aboundary
structure on a scale of 376 km or less, and/or
high frequency is 0.21 Ms) large amplitude
tamponingent with global steady state.
reconnection but are compatible with localized
patchy reconnection.

icophys. Ros. Lots., Paper IL0863

ATTION-LONGITUDE STRUCTURE IN THE SOLAR WIND thand J Bhodes, Jr. and Edward J Bmith the Tropalsion Laboratory, California Institute if Jacholesy, Jeandems, CA 91103)
The holographic Latitude-longitude structure of his pred solar wind atreams observed prior to the mainess of solar yells 20 has been studied with a multispectraft comparison. Plasma and markets of leid date obtained near the earth by Espirera M and 15 during aid-1967 were mapped "Milly Luward to the location of Mariner 5, which was seking simultaneous measurements at lower his observable for a total duration of which was reking simultaneous measurements at lower his observable in 10-day interwels for a total duration of his object contained. For latitude apparations of the solar contained, For latitude apparation of his object contained, For latitude apparation of his object contained. For latitude apparation of his little difference in longitude distribution of the first latitude separations ranging from 3.5° to 6.2°, signal ican difference in longitude distribution of the first latitude separations ranging from 3.5° to 6.2°, signal ican difference in longitude within two longitudes within the longitude within two longitudes within the first some the stress while his lower-latitude Hariner saw a single of the contained within two deserved at twelve some a single high speed at no saple of 70-80° from solar north-mouth is data whis indeed by Polocers 6 and 7. They laply sonth velocity spridence, or wind shears, increase are the militaned by Polocers 6 and 7. They laply sonth velocity spridence, or wind shears, increase in the militane within two bears of large, temporary, local north-mouth is data whis include springer, temporary, local north-mouth is data whis include springer, temporary local north-mouth is data whis include springer, or wind shears, it will be a lating to the sprin nemer system on ISEZ-3 for upstress of the earth's bow shock. These upstress bursts fall into distinctive groups the first group in accompanied by energetic electrons (~ 75 haw). accompassed by energetic electrons (~ 75 hav),
the proton spectrum extends up to energies

A 300 hav and higher and bands over towards
lower energies (~ 30 hav). The second groupwhich is unaccomposited by unergetic electron
bursts, enhibits spectra which can very well be
represented by exponentials in energy with a
sequenced cliffing energy of ~ 15 keV. We have
supplemented these data with messergments obtained with an identical sensor system on 15EE-1
close to the bow shoch or wichin the geomagnatic
tail. Whenever ISEE-1 is upstream of the bow shock
and ISEE-3 observes a butst of group 2, ISEE-1
observes diffuse upstream long. When ISEE-3
observes diffuse upstream long. When ISEE-3
observes burst of group 1, ISEE-1 observes
either no bursts, diffuse tune or highly enhantropic distributions: It is suggested that group
1 is of angentospheric origin while group 2 is
bow shock nespotated.

Combart, Ret., Slue, Paper 141026 J. Geophys. Res., Blue, Paper 1A0678

S733 Agnotopause
Evictic FGR MAGNETIC FIELD RECOMMECTION AT THE
FARIM'S MAGNETOPAUSE
B.U.O. Sonnerup (Eartrouth College, Manorer,
N.M. 31755, (7A) G. Faschmann, I. Paparastorakis,
N. Schope, G. Magnendel, S.J. Bare,
J.R. Astridge, J.T. Gostling, and C.T. Sussoil
Eleven passes of the ISEE satellites through
the frontside terrestrial dagnetopause (local
ting 9-17 h; GSM latitude 29-43 h; have been
identified, where the plasma velocity in the magnetopause and toundary layer was substantially
larger than in the magnetosheath. Into goverevanines the nature of the plasma flow, magnetic
field, and energetic-particle fluxes in these
regions, with a wiew to determining whether the
velocity enhancements can be explained by magnatic-field reconnection. The principal quastion is whether the observed difference in tangential plasma welocity between a point in the
magnetopause or boundary layer and a reference
point in the adjacent sagnetosheath, had the
save direction and magnitude as that produced by
the Manuell stresses in the casgnetopause. For the
11 cases, the average ratio of observed to predicted selecity difference was in the range
0.6-1.2, with a composite average of 0.8. The
average angular error was - 250, with a composite
average of 100. The plasma results would require
10 of the crossings to have been located north
of the reconnection line (D, ·0). And one (at
2.40 N lat.) scuth of it (D, ·0). The Bn values
othatened from minimum-variance analysis of the
magnetic data were mostly poorly determined, but
in general their signs were consistent with the
plasma results. In actuard cases energetic magnatospheric particles with the proper flow
anisotropy, and, one case, reflected magnetosheath particles, were observed outside but
adjacent to the magnetopause. All of these
results support the reconnection hypothesis. The
energetic particles were also used to identify
the outer separatric surface. The electric field
tangential to the magnetopause is inferred to be
in the range.

J. Geophys. Rem., Blue, Paper 140941

J. Cacphya. Rem., Blue, Paper LAG941

3233 Planes (astabilities
ROMENICAL STORY OF EXPLOSIVE YEARING MODE
RESTABILITY IN ORS.-COMPONENT PLASMAS

7. Tessees (institute of Space and Astronautical Eclerc, 1-6-1, Founda, Maguro, Tohyo, Japum)
A maserical simulation is performed to investigate the howlinest phans of the collisioniese
tearing mode instability. The results are found
consistent with the prediction of the theory by
Galaxy. Carositi, and Ashour-Abdalla, who predicted the silateness of an explosive phase of the
leastability closed by the magnetization of particles by the perturbed component of the magnetic
field moral to the neutral sheet. Since electropicatic affects on the avolution of the instability are explected a priori in the present mumerical aleulation, we do out, obtain the final
answer. But there seems to be a good possibility
of the explosive evolution of the testing mode
instability in its monitoser stage. It is argued
that for a sufficiently long, averlength parturhation the monitosay explosive evolution of an
become faster than the monitorar coalescence mode.

It to further noted that the particles are heated come faster than the monlinear coalescence mode. It is further noted that the particles are heated adjustantically within the magnetic islands by the one-disensional compension process. (fearing mode instability, magnetic reconnection, magneti-tali, planta chost).

5755 Finms instability LOWER-WIND-CHIFF PRIVALILITY AND ITS ASSOCIATED ANOMALOUS RESISTIVITY IN THE NEVITAL SHEET OF EARLY'S MAGNETOTAL

ANGULATE RESISTENTE IN THE REVIEL SHEET OF
EARTH'S MACRITUTAL
Laryin by (Dept of Earth and Space Sciences, Unitversity of California, Los Angeles, CA 90074),
E. B. Quest, Dy (Dept of Earth and Space Sciences, Unitversity of California, Los Angeles, CA 90074),
E. B. Quest, M. G. Eivelson and C. Tu

It has been suggested previously that at the center of the serth's plasse sheet there exists a thin
non-adiabatic laryer, the neutral sheet, whose
thickness is of the order of the ion gyroradius.
The Ion distribution to such a thin sheet may have
some man-carwelliam form. The purpose of this
paper is to construct a one-distantional "monmenvelliam" model for the steady neutral sheet and
to thandse its famility preparties with respect
to the lover-hybrid-driff (LED) were. A combination of a Boltzman distribution and a modified
Alpers' distribution for lone is taken. We show
that in the limit of a thin matural sheet, this
distribution is a more powerful mource of free
emergy than the usual drifficing marwellian. It is
found that most regions within the neutral sheet
are uncatable. The frequency spectrum of the unstable weres is marry the asses as lot the drifting
marwellian case. As shown previously by Bute at
al. (1918), the frequency spectrum is no good
agreement with the observations. The growth rate,
ass-ming a modified Alpers' distribution function,
in found to be anhanced compared to that due to a
drifting marvellian model in a portion of the
entire that using current relaxation as the stebilining sachanism and are found to be 1-4 times
larger than those in a marvellian sheet.

J. Geophys. Res., Nuc. Paper 140931 J. Geophys. Res., Blue, Paper 140973

3760 Flashs sotion, threaten or circulation THEEL-DIRECTAL CONTINE MODELLING OF DYRMIC RECORDSTRUCT IN THE GEOMETRIE TABLE.

J. Sirm (Subr-Universitat Bockum, D 4610 Bockum, W. Germany) E. V. Ross, Jr.

The unstable dynamic evolution of the magnatomatic line repress to a sudden occurrence or anhaccemate of resistivity is studied by means of a threa-discontant, time-dependent, sou-linear, resistive WED cole. We start from a resistic three-discontant allegant that model including flaving in yand a sad plasms that thisbasing towards the Flashs. Many features that are believed to characteries the expansion phase of substruct developed without any device sechanism at the biodary. Confirming mariter twodimensions results, we found plasms best thinning, occurrence of strong flow and magnitum Eq.
induced electric tields and formation of neutral ileas and a init-ward moving "magnetic bebbia" or "plasmid."

En addition, the results show that the occur-ence of B. < G and the shape of the regtral rence of S<sub>e</sub> < 0 and the shape of the mestral lines are sure couples than in 2-0 wedge with the organize S<sub>e</sub> generally more restricted to time and space than accord talloard flow. The in-crease to plassa best thickness and S<sub>e</sub> toward the flanks of the tail causes the reconnection and succeeding process to be itmited to the yellocation. Bettheurid from the main k-line a and succionation process to be implied to the y-direction. Batthward from the main K-line a direction of the stourneast current in found, teing settlered on the dawn nide of the stil and talkard on the dush side. Although the augment field torus so so to stay nearly perpendicular to the directed turent, set Etalia-sligand components of the current result inside the planes where. Pere have the signatures of region 2 currents litting and fotpara, 1976) flowing tailward on the dawn tite and sathward on the dush side. (Computer andelling assemble exceptagion). J. Edwybys. News., Blue, Taper 18044)

J. Garphya. Rec., Blue, Taper 18044]

SERO Phases motion, conception, on circulation COMOTALING MCCMETTAGE TO PROTECTION

I. W. Hill (Cost. of Space Physics and Astronomy, Rice University, Mastem, 11 77021), A. J. Cessier engl. J. Mahar

The longitudinal asymmetry of the 10 olsess tours, as are-litted by the magnetic-momenty model and contection system in Apriter's magnetosphere, here we state some qualitative properties of this convection system in Apriter's magnetosphere, here we state some qualitative properties of this convection system in Apriter's magnetosphere, here we state some qualitative properties of this convection system in Apriter's magnetosphere, here we state some qualitative properties of this convection system as staten. The convection system made a system, the convection system made a system, the convection system made convection system made and for restation periods) and the dominant mechanism (with a limit cartific position) and the dominant mechanism for extracting energy from Apriter's restation (at a rate - 10) My for driving a wide variety of magnetospheric phenomens. A similar cartification-mated magnetospheres, for example, that of Saturn.

J. Goophys. Res., Blue, Paper 180718

J. Geophys. Res., Size, Paper 140175

5760 Plasmi metion, convection, or circulation of the libritim And Scattering of Protons in supplier's Magazingtheff D.D. Earthona (Institute of Geophysics and Planetary Physics, Internative of California, Los Angeles, California 19002a). We investigate a model by which 10 keV protons are steared and localized by which 10 keV protons are steared and localized to the ragnetic equator. The critorion that the branch density may be sufficiently large to generate magnetonnic waves leads to the regulation of proton beam fluxes cannistant with recent Wayager observations of a hot high 8 plasma sheet in the magnetosphere. A redei of the Aliven speed in the plasma sheet for both inhound and outbound legs of the Vayager i encounter is presented. This model conflicts beyond the point where the rigid body corotation speed equals the Aliven speed. Finally we emplore the peasibility of non-aliabatic meastering of super-Alivenic ions by magnetohydrodynapic waves throughout the plasma sheet as a basis for high-energy tail formation of ashiems particle distributions.

STAIN Places motion, convection, or circulation observations of Fitth Aligned Bon AND FLECTRON BEAMS FROM SCATHA (F78-2)

J. D. Richardson (Space Sciences Laboratory, The Aerospace Corporation, F. O. Bon 97557, Los Angelms, CA 90009) J. F. Fennell and D. R. Crubey, Jr.

Intenso fited-aligned beams of ions and electrons have been obsorved by electrostatic snalyzers on the SCATRA (F78-2) satellite. The beams have peaked energy spacers with snergiss ranging from tens of eV to several keV. Those beams show a strong local time dependence, with securitates frequencies peaking near local midnight. The occurrence frequencies of thems beam are also positivally correlated with Kp. Crepations have been done with \$1-1 observations of field aligned to fluxes, suggesting a direct relationship between acceleration of lons at low sitifude in the sureral region and the observation of field aligned beam at the equator near year, brotours cribit. evn. bromous cirbit. I. Grophym. Res., Blue, Paper 140941

iting of field aligned beams at the equator near each breaks cribit.

Erophys. Res., Blue, Paper 140311

1740 Plasma matios, convection, or circulation EVALITY OF THE MAGNETIC-FUEN-TUBE AND EXECTRIC CURRETY DESCRIPTORS OF MAGNETOSPHERE FLASMA AND EVENTS DESCRIPTORS OF MAGNETOSPHERE AND EVENTS OF MAGNETOSPHERE AND

main-field-aligned electric fields are con-eldered and the variation in the flow when the east-wast component of electric field parallel to the arc is included. Quiet different planus transport may result even though the north-south maridism cross-cartions are the same. (Magneto-mbers, convection) sphere, convection). Rev. Geophys. Space Phys., Paper 180915

3770 Short-period (less than 1 day) variations of magnetic field possible CRANGES IN EARHEAL Pc 1 PULSATION ACTIVITY CAUSED BY BARY E. Sandani, A.C. Framer-Smith (Radioscience Laboratory, Stanford Electronics Laboratories, Stanford Chivarairy, Stanford, Calif. %303) O.G. Willard, Jr.

La sprevious praliminary study of the disranl variation of Pc 1 pulsation activity at Stanford during four months in 1975, evidence was obtained for changes in the state of occurrence of the pulsation activally and terminated by the San Francisco Bay Area Rapid Francis (Bak7) system [Franc-Saith et al., 1979]. The present study extends this earlier work by analyzing Pc 1 pulsation data recorded at Stanford during 1976. Spectrograms of N-S geomagnetic activity were prepared for the complete past and 15-minute Intervals Containing Pc 1 pulsation activity were prepared for the complete with the study were tabulated. The distract variations of the Pc 1 activity (se manured by these 13-minute intervals) for weshays, during which BARY was not normally in operation, were compared. Correlations of the observed differences with the BARY achedule august once again that the ultra-low-fraquency electromagnetic noses produced by BARY are beful august once again that the ultra-low-fraquency electromagnetic that the witte-low-fraquency electromagnetic naise produced by SART may be influencing the occurrence of Pc 1 pulsations along the Stanford

growagnetic meridian. J. Geophys. Res., Sine, Paper LAION.

Sito Short-period (less than i day) variations of magnetic field CLUSHFICATION OF MYDROMAGETIC ENGRISORS AASED OF PROMISESTATION STRUCK. B. PAGESION (Sational Institute of Polar Papearch, 9-10, Kaga I-chome, Finbanhi-ku, Tokyo Hij, Ingaa) T. Toya, K. Kothe, M. Myrashima and M. Rayamura.

ruseich, 9-10, Aga 1-thome, Tibeshi-hu, Tokyo 119, Ispah T. Dya, K. Hoite, M. Mershim and M. Ravanura.

W. Ravanura.

Using 1935 bydromagnetic emission events observed in the frequency range of 0.1-2.0 Mm at 50000 (10.6), EM emissions have been classified into sight subtype based on their spectral alvestures, i.e., EM visitor, periodic EM emission. EM chorus, EM emission between the Frequency normals frequent EM emission. If it seems that each subtype has a prefurential magnetic normal frequency hand also a frequency range for its necessary and also a frequency range for its necessary day for the magnetic normals bour, while dispersive periodic EM emissions, and EM emission bourds occur around magnetic loyed moon, then EM effects emissions vary free high frequencies in the stermon hours. Furthernaire, it is noticed that the efferteduced in the sourch periodic by the to low frequencies in the stermon hours, Range to low frequencies in the stermon hours, Range on these products of the polyphone of instruments, in the stermon hours, Range of the polyphone of instruments of the polyphone of the pol 4. Googders, Ags., Line, Paper 140978

Sylo Wave propagation
BINALTANBOUS GROUD-BATELLITE OBSERVATIONS OF
GRASI-PERKIDDE (GP) ELF-VLF EMISSIONS FEAR L-6
H. Bato/Hational Institute of Polar Rasearch,
9-10, Kaga 1-choss, Itahashi-ku, Tokyo 173)
H. Pakunishi, T. Osaki and T. Yoshino
Binaltaneous ground-satellite observations of
ELF-VLF emissions have been carried out at Syova
station (U-6) in Amaratica during the USS period
by recieving the telemetry signals from the ISIS
1 and 2 satellites. The quasi-periodic intensity
modulation of ELF-VLF emissions at the satellite
level, which had one-to-one correspondence with
the intensity modulation of QF emissions at Syova,
was observed in the wide latitude range from -54°
to -76°MLAT, and also in the region 2 hours apert
from Syova in magnetic local time. The spectral
form of QF emissions observed on the ISIS satellite showed a olear dependence on latitude, i.e.,
emissions in the higher frequency range were
observed at lower latitudes, while emissions in
the lower frequency range were observed at higher
latitudes. Although quasi-periodic intensity
modulation of polar showns had generally one-toone correspondence between the ground and satellite data, burst-lite disporter missions statelbut deta There results after a busife to confirm lite data, burst-like discrete missions of an other always one-te-one correspondence between both data. These results give a basic to confirm a phagemenological model proposed by Sato and Putnighi (1951) for the generation mechanism of QP endssions. (FLF emissions, ground-satellite

J. Geophys. Res., Sine, Paper 1A1625

5799 Ceneral (Spacecraft Charging)
OBSERVATIONS OF DIFFERENTIAL CHARGING EFFECTS
ON ATS-6

OBSERVATIONS OF DIFFERENTIAL CHARGING EFFECTS
ON ATS-6
N. C. Olsen (Physics Department, University of
Alabama, Euntaville, Alabama, 35899), G. E.
Koliwain and H. C. Whipple
Farticle data from the UCSD experiment on ATS-6
shows the axistance of an electrostatic barrier
around the ATS-6 selence packaga. The 10 eV
to 1 keV barrier to electrons is shown to be the
result of charging on dislectric serfaces around
the science package to potentials substantially
more negative than the mainframe. Normal observations were modeled with a spherical, monspole
plus dipole potential simulation, and MASCAY, a
thrse-dimensional, rectangular code. The analymis showed the large dish antenns on ATS-6 could
produce a 60 V barrier by charging 220 V more
negative them the -80 V mainframe. Observations
of intense fluxes, narrowly confined in angle
and energy, were tracked to the insulating
surface of the University of Minnasce rotating
detestor, located on the otherwise conducting
science package. (Charging, electric fields,
particle measurements).
J. deophys. Res., Blue, Paper 1A0651

# Physical Properties of Rocks

Silo Elasticity, fracture, and flow POTENTIAL FOR GEORM'SICAL EXPERIMENTS IN LARGE SCALE TESTS
James N. Disturich (U.S.. Geological Survey, 145 Kiddlefield Boad, Menio Park, CA 94025)
Fotential research applications for large-specimen gamphysical experiments for large-specimen gamphysical experiments of scale dependence of physical parameters and axamination of interactions with heterogeneities, superially flaws much as cracks. In addition, increased specimen size provides opportunities for improved recording resolution and greater control of appariamental variables. Large-scale experiments using a special purpose low stress (40 MPs) blexial apparatus demonstrate that a minimum fault length is required to generate confined shear instabilities slong pre-caleting faults. Experiments analysis of source interactions (or Experimental analysis of source interactions (or standard earthquakes constating of confined whear instabilities on a fault with gouge appears to require large specimens (-in) and high confining presentes (>100 Mps).

despitys: Muse. Latt., Paper 1107%

610 Elasticity, fracture and flow EYDEMECHABICAL SHAVIOR OF A DEFORMABLE ROCK FRACTURE SUBJECT TO KORMAL STREES 1. W. 7sang and P. A. Witherspoon (Earth Sciences Division, Lewrence Berkeley Laboratory, Berkeley, California 94720, U.S.A.

Odvision, Lewisson Berkeley Laboratory, Berkeley, California 94730, U.S.A.

A simple physical model is developed to understand the effect of morsel arress on fluid flow through a single fracture. Boughness along the fracture walls plays a definite role in controlling the flow. In the usual parallel-plate representation for a fracture, the flow is proportional to the cohe of the constant sperture, b. However, when the effect of fracture roughness is taken into armout, the flow follows an aquivalent "cubic" law where the mube of the single value for the apparture must be replaced by an appropriately weighted average Co<sup>2</sup>). To obtain this average value, a physical model was developed wherein the single fracture a represented by a collection of voids and the clumpre of the fracture results from a deformation of these voids. The model anables one to characterize the fracture roughness from a relationship between the stream-displacement measurements of intent rock and those of jointed rock. This calculated value of Cb<sup>3</sup> leads to flow rate as a function of normal stress. Predicted flow rates using this model are in good agreement with results from laboratory date on granite and basatt. By mating several simplifying physical assumptions, we have eliminated the necessity of incorporating fitting parameters to the flow date. In this manner, a basic understanding of the factors controlling the flow of fluids through fractures has been obtained.

J. Goophys. Res., Red, Papor 180860 J. Geophys. Res., Red, Paper 180940

6110 Elasticity, fracture and flow SOME SIZE DEPENDENT PROPERTIES OF JOINTS AND FAULTS

R. Barton (Terra Tek, Inc., 420 Makara Way, Salt Lake City, Utah 84106, USA) Marked strength-size offects are observed when rock joints are subjected to shear. This is due rock joints are subjected to shear. This is due to the nobilization of larger, but less steeply inclined experities as sample size is increased. The displacement required to mobilize strength is also increased by the changing size of sample. These observed size effects indicate that large scale tests should be performed to obtain realistic data concerning shear behavior, districution, and disocieted permeability changes. An empirical sethod for numerically modelling the effects of joint roughness and sample size on shear strength and dilation behavior is described. Coophys. Res. Lett., Paper 116474

Sizo Equations of State
MUCONIOT EQUATION OF STATE OF
OF PHILLARE TO 200 GP2
N.S. Vassilion and Thomas J. Abrana (Suismological Laboratory 232-21, California
lamitiate of Tachmology, Fussions, CA
11123,USA)

Esu shook wave data on (100) oriented single
crystal periclase covering the pressure range
from 160 to 200 GFs suggest that NgG is
described by a single Magonic up to 200 GFs,
with my displacive phase transitions of volume
change greater than 1-1.5 per cent. For a third
order finite strain fit, with Ng constrained to
its sitrasocially determined value of 162.7
GPs, the implied Ng of 4.77 ± G.24 is in
agreement with the ultranonically determined
value of 4.17 ± O.14. The new data indicate a
sociatory politicals shock your results under
120 GPs." A previously published result at 258
GPs shows more compression to the light of the
present data than would be supposed for MgO is
the SI structure, and may signal the enset of phase transition, although we common confidently
make this interpretation. If MgO forms on ideal
support the occuprate of 3 significant
cransition in segmentobactite at lower sentia
pressures.

Geologya. Ras. Lett., Paper 11.0864 Pressures. Geophys. Ras. Lett., Paper 11.0864

6140 Magnetic and electrical propertion, ELECTRICAL RESISTIVITY OF MINERALS AND BOCKS AT HIGH THEMMODYNAMIC PARMETERS

I. I. Parkhomenko (Institute of the Physics of the Earth, Academy of the Sciences, Bolshays
Grusinskays 10, Moscow G-242, USBR)
The first part of the paper, after supplying general information on semiconductor and dislectric physics, describes experimental data about the dependence of electrical resistivity of different minerals on their cation composition within a wids temperature interval (up to 1100°C). The different character of dependence of resistivity on pressure is noted for minerals with mostly ionic character of electrical conductivity, and with valence of cations of iron. Experimental data are present which show the changes of electrical resistivity of minerals due to polymorphism dehydration, and decarbonstissation.

The escond part describes the results of study of resistivity of water-saturated sedimentary rocks at high preseures and temperatures. Data are given on the effect of porosity, pore configuration, sineral composition, concentration of slectrolite, content of clay, type of cresent and type of cementation on the character of resularity p = (f?). Moreover, a description is given of experimental data on resistivity of waternsturated magnetic rocks at high temperatures (up to 1.5 kbr). The last part of the paper analyses the character of dependence of resistivity of different groups of rocks on their mineral and chassical composition and on their structure under tonditions of high temperature and pressure. In conclusion, basic tendencies are indicated of interest for geophysics and for the usess of anyerimental data on electrical properties of mineral substances.

Rey, Geophys. Space Phys., Paper 180279

6180 Thermal properties
THE TEMPERATURE STABILIZATION OF A BORRHOLE
Y. Leblane (Oppartment of Physics and the Enstitute
of Earth and Planetary Physics, University of
Alberta, Edmonton, Alta., Canada T6F 2JI) F. W.

axperimental data on electrical property ainoral substances. Rey. Geophys. Space Phys., Paper 120279

Alberta, Edmonton, Alta., Canada T67 2317 F. w. Jones
Analytic solutions for the temperature stabilisation of both square and circular boreholes are considered. It is found that a previously published
solution for a square borehole in incorrect in that
it does not reproduce the initiality assumed conditions. The correct analytic solution for a square
well, as well as that for a circular well, indicates
a much more rapid approach to the formation temperature. The temperature stabilization curves for a
range of thermal diffusivity values are given.
GEOPHYSICS, vol. 46, no. 9

8120 Instruments and Techniques
8122 EFFECT IN ROCK TESTING
6. Beacher (Hessachusetts Institute of Technology,
77 Messachusetts Avenue, Cambridge, Messachusette,
U.S.A.) H. Einstein
Repirical relations between size and strangth
have found maple treatment in the literature, not
so the effect of size on the underlying mechanism.
This paper examines size effect on fracture mechanism in unconfined and triaxial tests smoog intact specimens of various saless and on jointed
specimens with various spacings. Scalistical
size affect and volume dependent strain energy
effect can be distinguished and are shown to
differently affect crack propagation and failure
mechanism. (Size offect, rock tosting).
Geochwa, Res. Lett., Paper 110677

# **Planetology**

6510 Atmospheres of planers A LOCAL DOSY STORM IN THE CHRYSE REGION OF HARS: A LOCAL DOSY ATORM IN THE CHRYSE REGION OF MARS: YIKING ORBITER OBSERVATIONS
Philip 5. James ( Dept. of Physics, University of Missouri - St. Louis, 51121) and Maccy Evens
A local dust storm was observed near the Yiking Lander I sits by Yiking orbiter I in September, 1977, when the areocentric longitude of the swa, L<sub>B</sub>, was 340° (shortly before vernal equinos). The orbiter observations, which consisted of a time sequence of pictures, show that the storm sowed at about 50 m/sec to the ENE from the Lunga-Pisnum region into the Chryse basis. Soth bescoling waves and topography may have been associated with the generation of the storm.
Goophys. Res. Lett., Paper 110937

4510 Atmospheres of planets
CHARGE EXCHANGE IN THE YENUS IONOSPHERE AS THE
SOURCE OF THE HOT EXCEPTED CHYDROGEN
R. B. Hodges Jr. and B. A. Tinaley (University of
Tarms at Dallas, P.O. box 688, Richardson, Texas
75080)

A global Monte Carlo model of the exceptors of Yenus, simulating the normal exceptorio processes, as well as the production of a 'hot' hydrogen desponent by charge exchange of k' with 3 and 0, has been computed. The resulting altitude profiles of atomic hydrogen aconcentration over both the day and might bemimpheres are in resecuted agreement with Mariner 5 and Harriner 10 observations of Lysan W, showing that the ionospheric charge exchange reactions are a significant source of 'bot' hydrogen, and possibly the domainst accurately hydrogen data alley for production of a similar amount of nonthermal H by chesical processes involving Ng. processes involving H<sub>2</sub>. J. Gaophys. Res., Bluk, Paper 1A0953

MARS ATMOSPHERIC OPACITY EFFECTS OBSERVED IN THE MARS ATMOSPHERIC OPACITY EFFECTS OBSERVED IN THE MORTHERN HEMISPHERE ST VIKIMO ORBITER IMAGING T. Thorps (Jat Fropulsion Laboratory, 4500 Oak Growe Drive, Passadama, CA 91109
Observations of changing Hars contrasts by Viking Orbiter releviation cameras have provided a description of changing atmospheric opacity in the Southern Hemisphers (Paper I). This report extends those measurements into the Hortharn Humisphers over a greater time period and provides a detailed description of photometric changes at the Lander sites as seen from orbit. Reflectivity changes competed with optical depth increases periticle scattering changes with stors evolution as well as substantial opacity in the Morthern Resisphers for the duration of searly a Martian year. rtian year. Geophys. Res., Blue, Paper 1A1043

6510 Atmospheres of planets PHOTOCHERICATY OF PROSPHINE AND JUPITER'S GREAT RED SPOT GREAT RED SPOT

N. Noy (Dept. of Geophysics and Flanatary
Stanaca, Yel Aviv University, Tel Aviv.

Israel) M. Fodelak and A. Ber Mum
The ultraviolet photolysis of phosphine,
which was detected in the Jovian atmosphere,
was investigated experimentally. A IX sisters
of FR, in H<sub>2</sub> was photolysed at 300, 200 and
77% and a yellow elemental phosphorus was
formed. This material was neither dark red as
the red phosphorus available compercially, not 77% and a vallow elemental phosphorus was formed. This material was nativer dark red as the red phosphorus available commercially, not was it resultive like the well known white phosphorus. The measured absorption apectus and film thickness of this material wars used to compute the wavelength dependent imaginary index of refraction, while its real index of refraction, or properties of spherical particles composed of the photolytically, produced yellow phosphorus were computed over a wide tedge of signs and optical thicknesses. The bestifft to this spectrum of Jupiter's dyeat he bestifft to the spectrum of Jupiter's dyeat produced this produced the p tild almospheres of planets
[OCL MAIS DUST STORM ERRERATION HECHANISM
[A. Syan (Earth Science Department, California
fisto butvarity, Fallerton, Fullarton, CA 9263a),
[B. D. Sharman and S. D. Localch

D. L. Sharman and S. D. Localch

D. L. Sharman and S. D. Localch

The state of the state of the state of the planets, a local dust storm was observed at the
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. The
Filing Lander #1 atta by Viking Orbitar A. Geophys. Res. Lett., Paper 110936

610 Alsospheres of planets

The CARDON MONNIDE FOURTH POSITIVE BANDS IN THE

THE SANCLOW I: SYMMETIC SPECIFA

Lawel T. Burrace (Laboratory for Atmospheric and

Save Physics, University of Colorado, Boulder, CO

Save Physics, University of Colorado, Boulder, CO

Save Physics, University, Baltimore, P. 21218)

Spectral, Observations of the Venus dayglow from

100-1800 A were made with the Pionear Venus ultra
violet spectromater (138 resolution), as sounding

motal telescope and spectromater (4 R resolution),

and the International Ultraviolet Explorer (0.4 R

resolution). Esissions due to HI, CI, OI, and the

O Sorth positive system are identified. Emission

res factors for the fourth positive system are

calculated using a high-resolution solar flux. The

ingerfance of solar maission line excitation to

this fluorescence spectrum is shown. In particu
lur, several bands of the v' = 14 progression are

festified and their excitation sechanism is shown

to be fluorescent scattering of solar Lyman-or radi
alter. The CO (14,5) band at 1332 A is a prominent

solution with the OI 1304 and 1356 K features in

lower resolution spectra. This identification

resolution spectra. This identification of the

rate of the OI 1304/1356 A missions from Vanus.

It also provides an additional remote sensing tech
lowed to dateraine the density distribution of CO

In the upper Atmosphere of Vanus.

(Airglow, carbon

mounted, oltraviolet spectrum).

J. Sophys. Ram., Blue, Paper 1A1031

### State of the control of the cont

SITS Surface of planets LINTES ON LARGE-CRAYER STRUCTION NO CHITEMPTON ON CALIFER AMOUNTS NO CHITEMPTON ON CALIFER AND SURFACE AS STRONG (LINEAR A PRINCE OF THE ASSESSMENT OF ALL STRONG AND AND ASSESSMENT OF A CHITEMPTON ON CHITEMPTON OF A CHITEMPTON OF Ms. Lout., Paper 120884

# <sup>Seis</sup>mology

(ii) Phenomena related to earthquake prediction of AFFLICATION OF GEOCHEMICAL METHODS IN IMPOUNT PREDICTION IN CHIVA
ling Fong-liang (W.K. Kellogg Rad. Lab.,
Cutten, Peadens, CA 91125) and Li Cut-ru
Scraral Ecochemical anomalica were observed
infore the Maichen, Longling, Tangahen, and
infore the Maichen, and infore the Maichen, anomalous
infore these lorge carthquakes. Before some
star reports of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" being amailed by
in the State of "ground colors" bei 

1701 Palanta Lources
1701 DEFTER AN EMPERT TREMOR REPRESENTATIONS
1702 PARTICIANES ASSOCIATED WITH THE
17 STALLOW EMPROPHERS ASSOCIATED WITH THE
1, 17 tice, (NET Macoln Laboratory, h2 Carleton
1, 17 tice, (NET Macoln Laboratory, h2 Carleton
1, 18 Sorth and R. W. Shields
18 Cand depths as the "A segment to 2h im below
18 sea floor very determined for 7 of the
18 sea floor very determined for 7 of the
18 sea floor very determined for 7 of the
18 sea floor very determined for 7 of the
18 sea floor very determined for 7 of the
18 sea floor very determined for 18 peths control
18 reputes of 13 season 1977. Depth control
18 reputes do control
18 reputes the time of the inimalocic very
18 season that the time of the inimalocic very
18 season that decipe date from the 18 season of 18 season date from the 18 season of 18

recorded by the SRO's and AGRO's broadened the source study to include earthquakos with moments as small as 10<sup>-34</sup> dyno-am; the small for either traditional first motion solutions or p-wave modelling. The inversion procedure was applied to data in the pass band from 30 to 130 sec. The propagation phase for the Love and the Rayleigh waves was calibrated with signals from two earthquakes for which the source phase was inferred from the P-wave solutions. Agreement with the corresponding P-wave solutions is nearly the same whether or not the smaller eigenvalues of the inner product matrix are retained in the inversions. The double couple components generally account for more than 3/3 of the total moment. Sormal faulting sings an east to northeasterly strike characterizes the mechanisms in the principal some of aftershock activity. Strike-slip mechanisms consistent with horizontal compression normal to the arc prevail in the delayed aftershock non-located 200 km northwest of the mainshock. Of the earthquakes subjected to this surface wave analysis the foreshoch stood out as having felt a significantly higher apparent stress, parhaps as much as can half an order of nagnitude higher than the others. These results suggest that accurate source parenters for moderate to small magnitude earthquakes could be routinely determined from surface waves recorded by the SRO's and ASBO's. In particular, the neshanisms of small magnitude Coreshochs could be obtained in this way. (Focal Lepths, Howent Teners, Ureat Sunba Earthquake).

J. Geophys. Fes., Red, Paper 190526 J. Geophys. Res., Red, Paper 180526

6970 Structure of crust and upper mantle
SBISHIC AMISOTROPY GASERVED IN UPPER OCCAMIC CRUST
R. A. Stephes (Woods Ecle Geanngraphic lustitution, Woods Ecle, NA 0234)

Belsmic anisotropy in the upper 1500m. of
occasile becoment has been observed by polarisation analysis of three-component borshels estamotation analysis of three-component borshels estamotation analysis of three-component borshels estamotation analysis of three-component periods for
the anisotropy is sheer were aplitting for suplosive sources at four snimmins. Compressional wave
particle motion deviations suggestive of anistropy
are also observed but they may be caused by lateral inhumogeneties. The anisotropy was not resolved by travel-tiam enalysis. The observed
velocities and perticle motions in the borizontal
plame can be modelled to within a standard deviation by sessining a perfectly elastic, brokeneous,
anisotropic layer 2 with hexagonal symmetry and a
horizontal symmetry axis. The most probable cause
of the anisotropy is preferred crack orientation.
Geophys. Res. Lett., Faper 11.0995

6978 Structure of the crust and

UPPER BANTIE STRUCTURE ALONG THE NORTHWEST EDGE OF THE SHAKE RIVER PLAIN INTERPRETED FROM SEIGNIC REFRACTION L.W. Pankratz (U.S. Geological Survey. Denver Federal Conter,
Denver Federal Center,
Denver, Co., 88285) M.D. Ackersann
The results of a seleste refraction
survey at the Idaho Mational Engineering
Laboratory along the northwest boundary
of the Snake River Plain shoos that veloof the Snake River Plain show that using the Snake River Plain show that using the universe of the Snake River Plain increase from 1.5 km/sec at the surface to 5.2-5.5 km/sec at depths notween approximately 2808-2558 seters. An exploration well in the area (INCL-1) annountered Cenoxolc upleanio rock with some interbodded sediments to a depth of 2460 meters underlain by 780 meters of a rhupdactic porphyry. The refraction data demonstrate a nearly fault-like discontinuity of about 1888 meters of singular that the plain about 1.8 km from the southeast flank of the Arca Milistost River Range). Mether this discontinuity represents the northwest flank of the Snake Aiver Plain graben, the sat flank of the Lost River Range fault, or a caldera mail is not known. The results further indicate that Palwszoic rocks may extend beneath the plain as far as 8.6 km southeaster of from the Arca Milis.

southerstward from the Arca Hil (metamic refraction, Snake River Flain)

6970 Structure of the great and upper mastle
A COMPUTER MODEL STUDY OF THE PROPARATION OF THE
LOGG-MAKE IN FIRMS
Joseph F. Gattrout (Hawai Institute of
Geophysics, University of Eswali, Hemoislu,
Hawaii 96212) and L. Seil Fraser
Synthatic long-range (high-fraquescy) Fe phases
that fit both the arrival times and, more
importantly, the characteristic long code
duration of this phase are generated uning a
velocity-depth model consistent with long-range
refraction and surface were observations. These
synthatics show that a crustal guided-wave plays
an important part to the character of Typical'
long-range Fr codel in pericular, the largest
applitude arrivals at ranges greater than about
6° propagate through the crustal wave guide.
Comparison of a synthetic long-range Fg mignal
with an observation of this phase as 6 range
suggests that any F-velocity inversion at the
base of the lithouphers must be small. This
result is consistent with the anomalously high Q
values for Su previously reported by other
authors since a F-velocity inversion means
that transling would extract such more
low-fraquency energy from long-range St than it
would from long-range Fm. (Salumology, synthetic
solumnysm., crust and upper mantic, competer
modeling).

Geophys. Res. Lett., Paper 1LOSOS

Geophys. Res. Lett., Paper 110506

6970 SETUCIUES OF the CTUST and upper mantle
A DIRECT MEASUREMENT OF THE DISTANCE SETURES A
HTPOCENTER IN A BENIOFF-MANATI ZONE AND THE
SLAB-ASTHEOSPHERE CONTACT
JUMPP P. Stefasi (Department of Geophysics,
Stanford University, Stanford, CR 94305)
Robert J. Geller and Gless C. Krosger
We unde a direct unasoursemen of the detence
from a hypocentor in the Senioff-Madati zone to
the boundary between the downgoing slab and overlying astheosphera. This was accomplished by
identifying a low smpittude P wave reflection off lying asthenosphers. This was secomplished by identifying a low smplitude P wave reflection off the slab-submonosphere contact which errives at relection several seconds after the initial P arrival. The measured delay line (after P) of the reflected phase shous a consistent asisuchal variation, thus eliminating possible source or receiver affects. The relative amplitude, polarity and delay time of this observed phase are consistent with a model in which the distance between hypocenter and slab-suthenosphere contact at this depth is about 186-3 km. sucheoosphere contact as an intermediate depth.
The avent studied was as intermediate depth (183 kg) eartfunks in the southern kurlies which occurred in the lower layer of a double-planed seismic some. Our measured distance, when compared to the distance that the contact cones, indicates that the upper layer of soismic cones, indicates that the upper layer of soismic try is within 15 is of the sisb-sathono-

.. Geophys. Row., Red. Paper |B1011

6970 Structure of the crust and upper mastle
BEIGHIC PROPERTIES, DESIRY AND COMPOSITION OF
THE ICELANDIC CRUST FARD REVOARPINGURA
Histora. I. Christmanso (Separtman of Geological Sciences and Geophysics Program, Interactly
of Weshington, Seattle, tophishcom 20195) and
Noy E. Withous

Compressional and shear mays velocities,
demaittes And, paropities have been memored to
don'thing pressures of 5 har for 13 samples
from a deep borehole in ematery Iceland. The
measurements are from a render lealand. The
measurements are from a render lealand
within the flow builts are relatively low de the
tops, reach maximum values within depictel pertions and decrease mear the bases. This pyacetions and decrease mear the bases. This pyacetion and decrease mear the bases. This pyacetion and decrease mear the bases. This pyacemakic variation correlates well, with depictel
on the other hand, have relatively uniform
valocities, which are appear, markey equivalent
to maximum valocities majoured within flow
to maximum valocities majoured within flow

units. Below 70% neters, the dife and flow velocities show systematic lawre now with depth which are related to chances in exactions and independent of persetty. In velocities addited by the laboratory we locities and approximates (i.e. "i. in your agreement with field refraction measurements. Fight selections must be needed to the laboratory approximation of the laboratory persons and the laboratory and the laboratory is a laboratory in the laboratory in the laboratory is an approximation of the laboratory is approximately in the laboratory is a laboratory which is a laboratory with the laboratory with the laboratory is a laboratory with the laboratory is a laboratory with the laboratory with the laboratory with the laboratory is a laboratory with the laboratory with increasing aftern has with depth and, for particular, on increase in epidate content, the abundance of epidate to the rocks reconsist from the base parties of the drillbade supports a peraporphic origin for the lawer /- lawer I boundary in this technic technic eriosity, density, Fusali). J. Geophys. Pos., Ptd. Paper 151011

# Astrophysics, and Astronomy

# **Tectonophysics**

8130 Heat the THEMBAL CONDUCTIVITY AND TEMPERATURE STRUCTURE OF THE REPORTFORDUR BORROUR.

E. R. Obburgh (Department of Earth Sciences, Deuming Street, Carbridge, England) and S. O. Agrell.

One bundred and temperaturements of thermal conductivity have been eithern supplies over a 1900m depth interval in the Repdartjordur berechold comprising targete baselts. However, the conductivity of both the weal interviews for reasys with depth by about 74%, reaching a maximum value of about 1.9 M m<sup>-1</sup> C<sup>-1</sup>. This increase travells from the growth of secondary mixtures in results from the growth of secondary mixtures. dry function tradition from the groun of security of the properties of fifth and ward depth and 10 new cases replace phases having lower values of thermal confunctions.

The conductive heat the between time and the outline may about 100 mm m<sup>2</sup>. Period for the conductive heat the accordance has been those properties for the left through the period of conductive heat the appears to be next than built the mar surface value and there is strong sendence that in this leptonic rest the thereto appears to be determined to the dark the surface and the dark thereto appears or end fined by head thereto the third the lattice of the dark the surface and the su

SIEV Heat flow
THE VERDETORY PADDICTED AT PROVIDE FAILABLE THE VERDETORY PADDICTED AT CAST FOR ALL.

SUPRACRUSTAL STRATA AT CAST FOR ALL.

SUPRACRUSTAL STRATA AT CAST FOR ALL.

SUPRACRUSTAL SECTION FOR CONTINUING HEAT FLOW
LOOK REAL ADVANCES OF THE ACCORDANCE FOR THE ACCORDANCE FOR ALL AFTER
THE doction of the Mitwaters of the Accordance between
The doction of the Mitwaters and busin and the
underlying Archem basedoning ranner. The
total crustal thickness is N.D. by and the
Average ceasured heat flow is 4A rend.

A redort, fift, is to the south of the Highsdorp-Carletonville area, Archem grantic
form the core of an updored and coefficient
asquence of strata. Percoat guardonis if and
geological studies provide evidence that the
Vendefort basedoning ranner has also been overturned, exposing a NID by thick vection of
the Archem crystalline court. Profiles across
the Vendefort basement, together with brea-

# Solar Physics,

7799 Soler physics, discolinacous
MITRATE 103 IN ANTAPCTIC FIRM AS A MARBER FOR
BOLAR ACTIVITY
E. J. Zolist (Department of Geology, University
of Kanssa, Lawrence, Fansse 66025) B. C. Parbor
Firm cores from South Pole and Vostok etations
have been analyzed for uttrate to determine if
variations in concentration can be related to
known variations to soler activity. Bath analytcal records are roughly 1200 years in length and
are based on 1635 individual analyses from the
108 is Sauth Pole core and 198 analyses from the
tops 47 meters of the Vostok core. Although the
tocalities are separated by 1300 by, there is
substantial stellarity between the records and
the Modero Marimus, Hunder Minimus and Medieval
Maximus are present in both curse. Harponic
smalysis of core data and associated snow pit
studies imply a direct connection between sular
activity and obtrate connection between sular
activity and obtrate connection in antervic
(firm, (Solar activity, Antarctica, glaciology,
les chemistry),
fisophys. Res. Lett., Paper 110916

holes through the overlying strataled rocks, provide a unique opportunity of crawing a provide a unique opportunity of crawing the contribution of crawfal radioactive heat production to surface heat flow. Adopting two astrony models for best production on the locateopt the locateopt the locateopt the locateopt the locateopt the surface heat flow from radioactive heat generation in the crawful is calculated at between 29 and 34 mbm<sup>-2</sup>. Heat flow from the crawful in the Southwestern Transval action of the kappear crafton is estimated at herman 17 and 12 cbm<sup>-2</sup>. This lev uppercost antich heat flow is about held of that estimated for an oceanic lithosphere at equalibrium. Accordingly, the low flow provides astigated for an ideocanic region. The uncountly high catinate of crastal less production, and the corresponding low mantle heat flow are due to the or transposition. Published asternate that the reduced heat flow is an accept the approximation. deced best flow in an acceptable approximation heat flow at the base of the stable continental rust, are not supported by the

also Piate tectonics
PASENT DAY TECTONICS OF THE SOUTHEASTERN
CANTABRAN AND NORTHEASTERN VENEZULA
O. J. Ferra (Lamnar-Tuberty Geological Observatory of Columbia University, Palisades, New York 1994). Y. P. Aggarval
Four telemetered seasonic arrays were operated in northeestern Venezula during the number of 1919, resulting in accurate locations for about 100 microscretoqueless and four new foral mechanisms. On the basis of these new data, and geological evidence, we propose a new tectonic wodel for the acuthestern Caribbean. In this model, underthrusting of the Atlantic sea floor slong the Leasur Astilles is extended to the acuthest of Trimidad. The subducted slab is shown to dip northeesterly beneath Trimidad and the Caribbean Sea, penetrating depths of at least 150 km. This subduction terminates in the vicinity of the Los Bajon-El Soldedo fault some, that tread MNN-MN and is located in the Gulf of Paria west of Trimidad. Geologic evidence shows right-lateral, arrises also (RLSS) socion in this fault cone, probably mittated in the late Plicaces, occurs with individuate thrusting in central Trimidad. This WM-MN transing fault some june up with the Z-M trending if Pilar-Canamar fault system in northeestern Venezuela, that also moves right laterally. The El Pilar fault is apparently offset by Nobl crending faults that action at well as normal faulting. The estension of the Li Pilar fault not organism that the capita deformation pattern is interpreted to be the result of NM motion by South Arentes relative to the Laribbeam plate. In our unicepretation, the E-M component of relative European is accommissed by Nobl creating that this capita deformation pattern in Nobles faults and resulte in notal faulting on Nobles faults and resulte in notal faulting on the E-M component of relative European is resulted by Schale Component of relative European is also resulte in notal faulting on the E-M component of the E-M com

product work. Directions profess, best flow,

J. County of Person Bull, Paper 181958

E. Copley of Percy Red, higher thermo-

Gi50 Plate Tectonics
THE UNDERFAIRTIES OF PINITE MOTATIONS IN
PLATE TROTOBICS
3. J. Hellinger (Guite 7, 247 Garden St.,
Cambridge, Ma. 02138)
Incomplete howledge of the pattern of
magnetic lineations and foseil transfore
faults represented by sea floor spreading data on two plates generated by the
same epreading center leads to uncertainties in a reconstruction of the past
relative configuration of the plates. A
reconstruction may be represented by the
finite rotation that describes one configuration relative to another. In this
paper a method of reconstruction is provided that reflects the uncertainties in
the data. The method showing as weighted least-squares memoure of fit as a
function of the rotation prameters. For
a given rotation the measure of the
weighted distances of fixed and rotated
data points (representing corresponding
former plate cargin aggrents) from a
common plate rargin. The common agrin
is estimated from the locations of tota
fixed and rotated data points. The estimated cargin consists of a set of greatcircle eros. It is shown now the method
of reconstruction may be utilized to obtain an uncertainty region for the joie
and angle of rotation that characterize
the inite rituilon. These techniques
are then used to study the uncertainty
of reconstructions in the Jouth Facififor the times of anotalies 13 and 16.
The cest-fit recunstructions and law uncertainty region for the anotally 19 pole
are in good agreement with previous work.
However, the uncertainties in the anotaly 15 pole were substantially undercutimated by previous investigators.

8197 General or Hiscallaneous
PEDMARHLITY AND FRICTIONAL PROPERTIES OF SAM
ANDRAS FAMIL FONCES
C.L. Chu and C.Y. Wang (Department of Geology
and Geophysics, University of California, Berheley, California 94720), and W. Lin
The permeability of a San Andreas fault going
is determined under coefficing pressures up to
120 bars; it detreases with pressure from 10
rancdarcy at 15 bars to 0.3 menodarcy at 120
bars. These values are lower than the values
determined by Norrow et al. (1981). Five different samples of fault going with significantly different grain-size distributions were
sheared between total joints under confining presnures to determine the effects of grain size
and constitution on the strength of the fault
gauge. The strength of fault going clearly depends on its constitution and grain size distrinution, with the coarser sandy fault gauge being extronger than the finer clayer goings. Furthermore, the coarser gauge tends to strain harden after yielding, leading to greater strength.
Thus, on the fam Andrean fault, inhomogenetics
in going materials may cause spatial variations
for strength. Using the permeability deturnined
above, we extinate that the access pora presnure generated in the fault going samples during
the apprimental shear loading may be negligible.
(Fermeability, grain size distribution).
Geophys. Ras. Lett., Paper \$10.619

# Izvestiya Physics of the Solid Earth Volume 16, Number 1

# CONTENTS

Molodensky S. M., Kramer M. V. The influence of large-scale horizontal mantle inhomogeneities on the earth's tides
Taytolbaum Yu. M., Ponomarav V. S. The role of weak-carthquake swarms in strong events prediction Soboleva O. V. Changos in weak-earthquake focal mechanisms due to Nursk stora-

ge reservoir
Zobin V. M. Break-out phase and focal process of the Severe-Kurilak earthquake, 28 February 1978
Stiller H., Wagner F. K., Volstadt H. Earthquako procursors and pressure dependence of clastic wave velocities in cracked rocks
Vasilyev Yu. I., Shjerba M. N., Ivanova L. A., Molotova L. V., Sokolov V. L. Prossure capsule testing of the borehole mothod for stress measurements in a shock

wave Gordin V. M., Mikhaylov B. O., Mikhaylov V. O. Physical aspects of approximation Danilov V. L. Shulman I. I. Application of fluid-dynamic theory of fluration to two-dimensional gravity inversion problems

# SCIENTIFIC COMMUNICATIONS

Monakhov F. I., Klasin I. G. New evidence for hydrogeodynamic effect prior to earthquake occurence
Ivanov A, P., Barsukov O, M. On automatic search for electric procursors to earthquakes
Zavoysky V. N. The use of remanent magnetization for determining eigenvectors
and eigenvalues of magnetic anisotropy tensor in rocks
Chernous M. A. Shjerbakov V. P. Fluid-dynamic implications for acquisition of sedimentary magnetization

Mikhaylov V. A. Permiskov P. P. The frost penetration problem in a half-infinite

medium with initially linear temperature distribution

78